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VIEWS, NEWS AND INTERVIEWS.

"The club *café* will be re-opened about the first of September," said Chairman R. B. Corey, of the New York Electric Club House Committee. "It will hereafter be a sort of a *café noir*, as we have engaged colored men as waiters. A well known caterer has taken the contract for supplying our members with food, drink and lodging, and we hope for a generous patronage of our service, which will be first-class."

The arc lights used to illuminate East 138th street are suspended from brackets attached to tall poles about 10 feet below the cross-arms, which carry the circuits. The poles are painted dark green, except that portion just behind the lamp. This is painted white for a distance of about six feet, and answers very well the purpose of a reflector.

The big electric light advertising sign at Madison square and Twenty-third street is a constant cause for wonderment on the part of our rural brethren.

Mr. L. H. Rogers, of the General Electric Company, has at last got his Mt. Washington search-light in working order. The other night messages were flashed upon the heavens by the Morse code and were easily read in Portland, about 85 miles distant. It is estimated that the beam of light was 80 miles perpendicularly above Portland.

Peter A. B. Widener, of Philadelphia, refuses to confirm or deny a report that he and William L. Elkins are to succeed Jay Gould as the controlling power in the Western Union Telegraph Company. Mr. George Gould denies the rumor, which is extremely improbable.

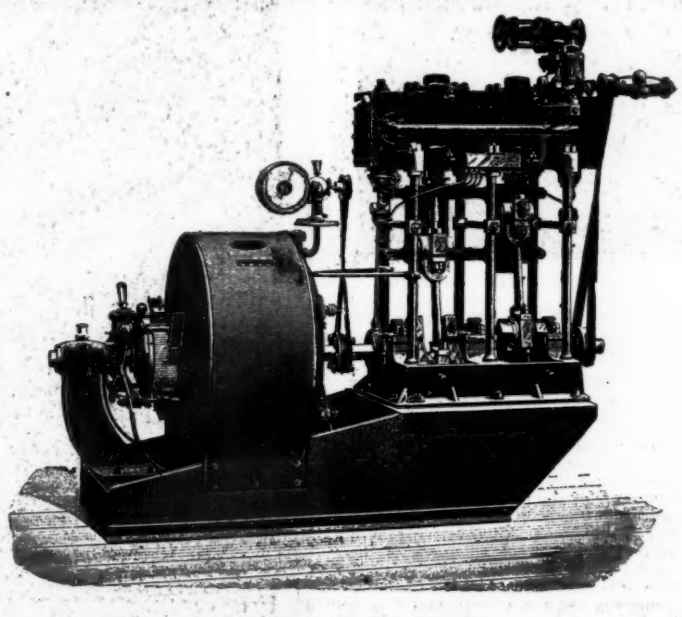
Her Majesty likes to have things done nicely, but I shall never forget the agony of one of our great electricians on being requested to map out the whole outline of Windsor Castle with incandescent lamps for some grand birthday function, at a maximum cost of (I think) £50. He calculated that the minimum on a poor scale would be about £750; but the Queen wanted it, and something had to be done. Eventually he compromised by suggesting instead a very beautiful *crown* of arc lamps round the top, and, by using scrap boiler and some old engines, managed to keep the expenses sufficiently low to meet the needs of even the Queen of the richest country in the world. —"*Meteor*" *in London Lightning.*

Japan is fairly well supplied with telephones and electric light, and now it is proposed to build two electric railways of 12 and 17 miles, respectively.

The Lowell and Suburban Street Railway Company, of Lowell, Mass., has adopted electricity on a part of its system. This threw out of service 75 horses, which were sold at auction last week. The advertisement of the sale announced that "the horses are all good ages, good colors and good size; are sound, or practically sound, will be honestly represented and sold for just what they will bring in cash." And thus goes on the emancipation of the street car horse.

Steam Dynamo for Ship Lighting.

The accompanying illustration, from London *Industries*, shows a steam dynamo for marine work, made by Messrs. Wilhelm Smit & Company, of Slikkerveer, Holland. Four of these combinations have recently been supplied for the Dutch colonial warships "Sumbana" and "Lombok." The object aimed at in designing these generators was the production of a light but strong machine for running at low speeds. The dynamo has a large Gramme ring with internal stationary magnets. The output is 70 volts and 150 amperes at 190 revolutions per minute. The current densities are 2,500 amperes per square inch in the armature, 1,250 in the series coils, and 930 in the shunt. The machine will, however, give 225 amperes without undue heating. The armature is 36 inches outside diameter and 10 inches long, the iron being 2½ inches thick. The gramme ring is made up of disks of charcoal iron 0.03 inch thick, bolted on a bronze spider.



STEAM DYNAMO FOR SHIP LIGHTING.

It is unusual to use punchings of this size in dynamos, as it is very costly, owing to the great waste, unless the inner blanks can be used for smaller machines. Nevertheless it admits of a very strong mechanical arrangement, and Messrs. Smit & Company have, therefore, preferred to use 3 feet disks, 2½ inches broad, rather than sacrifice the mechanical design of their machines by using wire, or built up segments. The armature has 480 turns of 0.14 inch round wire, and 120 commutator sections. The field magnet has four poles, and as cross connections would be awkward in such a machine, four brushes are used to collect the current.

The engine is of the ordinary type, with 6½-inch cylinders and 8-inch stroke, and is supplied with steam at 160 pounds per square inch. The dimensions of the plant are: Length, 7 feet, 4 inches over all; height 6 feet and breadth, 3 feet, 4 inches, and the total weight, including the wrought-iron bed-plate, is 2½ tons.

The September issue of *Scribner's* magazine may be called an American number. Every contribution is by an American.

The Northwestern Electric Light Association.

The electricians, managers and officers of the electrical plants of the Northern Peninsula of Michigan and Northern Wisconsin, on August 19, effected an Association at Marinette, Wis., at a well attended and enthusiastic meeting, under the title of the Northwestern Electric Light Association.

The officers elected were H. C. Higgins, of the Marinette Gas, Electric Light and Street Railway Company, as president; T. A. Pamperin, manager of the Citizens' Light and Fuel Company, and president of the Electric Manufacturing Company, of Oconto, Wis., as Secretary, and Louis Lusk, president of the Edison Electric Light Company, of Antigo, Wis., as treasurer. The directors, C. S. Leykom, James R. Dee, F. B. Warren, A. A. Foreman and John F. Fitzpatric are gentlemen well known throughout the Northwest in the electrical business. The object of the Association will be the regulation, settlement and exchange of ideas concerning matters of mutual interest in the electrical business.

A number of honorary members were elected, including H. C. Hamilton, of Sault Ste. Marie, Canada; W. T. Sullivan, electrician of the Chicago Auditorium, and J. E. Bowers, president of the Crystal Falls board.

After the adjournment of the meeting the visitors, under the guidance and through the courtesy of President Higgins, inspected the well equipped and regulated electric light plant and street railway under the management of that gentleman. The next meeting will be held on October 12, at Oconto, Wis., at which full representation is looked for.

Buffalo General Electric Company.

The electric lighting and power companies of Buffalo, N. Y., have been consolidated under the title of Buffalo General Electric Company. At a meeting of the stockholders, held last week, the following board of directors was elected: D. O. Day, J. M. Brinker, Thomas Hodgson, James Adams, H. W. Bunt, C. R. Huntley, John I. Beggs, James L. Roberts, George Urban, Jr., W. W. Sloan, J. L. Williams, P. P. Miller, Franklin D. Locke.

The board of directors elected these officers: President, D. O. Day; first vice-president, George Urban, Jr.; second vice-president, John J. Moore; treasurer, W. W. Sloan; secretary, James L. Roberts; general manager, C. R. Huntley.

PHOTOGRAPHS OF ELECTRIC DISCHARGES.

Interesting and Beautiful Figures of Electric Discharges Described in an Address Read Before Section A, of the British Association.

BY A. A. CAMPBELL SWINTON.

I must first apologize for some want of novelty in the subject matter of this paper. When I originally undertook to read it, I was under the impression that the photographic figures with which it deals were entirely new. I have, however, since learnt that similar figures have been produced by others, notably by Mr. J. Brown, of Belfast, who described and illustrated some of his results in the *Philosophical Magazine* for December, 1888.

However, some of the figures that I have obtained differ considerably from those illustrated by Mr. Brown, having been produced under dissimilar conditions. Moreover, some additional experiments which I have made lead me to differ from Mr. Brown's conclusions as to the exact nature of the agency that is productive of the impressions. I trust, therefore, that I may be pardoned in bringing the subject to the notice of this section of the Association, especially as the photographs will, I hope, prove interesting to those who have not seen similar examples before.

The figures exhibited were all obtained without the employment of any camera or lens, and produced by merely causing the electric discharges to take place across the sensitive surface of ordinary argentic gelatino-bromide dry plates.

When single positive or negative discharges are desired, the photographic plate, the back of which is covered with a sheet of tinfoil, is placed between the two discharging points, and the strength of the discharge is regulated, so that while it shall spread over as much of the plate as possible, it shall not pass over the edge. The tinfoil performs a double function; it does away with the spark on the back of the plate, which would otherwise occasion a confused figure, and it also assists in causing a uniform spreading out of the discharge. It does not seem to modify the character of the figure produced in any way. It, however, affects its form, since if the foil be smaller than the plate, the discharge seems to have a great disinclination to extend itself beyond the edge of the foil, but would even curve round to avoid doing this.

The arrangement adopted when it is desired to obtain both positive and negative discharges simultaneously on the same plate, and when connecting sparks from positive to negative are desired, is similar, only in these cases the two discharging points are both placed on the film side of the plate.

For producing the discharges, I have employed three different arrangements.

1. A "Wimshurst" machine of the ordinary construction, with four small Leyden jars capable of giving five-inch sparks in air.

2. An "Apps" induction coil, capable of giving ten-inch sparks in air.

3. A "Tesla" high frequency coil operated by means of Leyden jars discharging

across an air gap. The jars being charged by means of the above mentioned induction coil.

In the case of the "Wimshurst" machine, single sparks were obtained with some difficulty by carefully turning the handle till a discharge took place, and then immediately arresting its movements. In both cases where the induction coil was used, a single discharge was produced by making the circuit before the insertion of the plate between the points, and breaking it once only by means of a hand operated mercury contact breaker.

Photograph No. 1 represents the figure produced by a single positive discharge from the induction coil.

No. 2 is a single negative discharge from the same.

The entirely distinctive character of figure produced by positive and negative discharges, respectively, will be observed.

It may be remarked that discharges obtained from the Wimshurst machine are exactly similar in character to the above, but when the Tesla coil was used, a distinctive form of figure, having both positive and negative characteristics, was produced.

In the paper already alluded to, Mr. Brown has raised the question whether the results are due to a photographic effect of the luminosity of the spark, or to some more direct "electrographic" action of the discharge upon the sensitive film. Mr. Brown favors this latter view and considers that the actual amount of light evolved is insufficient for the purpose.

In order to clear up that point, I have made several experiments. Covering the film with a thin disk of ebonite, I made a spark into the center of the latter. No effect was produced by the discharge until it had reached the limits of the opaque disk. Next, I repeated the experiment with a thin transparent disk of mica, in place of the ebonite. In the result the mica appears to have behaved as though practically non-existent.

In case the different electrical properties of mica and ebonite might have affected the results, similar experiments were made with disks of non-actinic ruby glass and clear glass; and it was found that while the ruby glass behaved as did the ebonite in stopping all action until the edge of the disk was passed, the clear glass allowed the action to take place all over the plate, though, on account of the thickness of the glass and the consequent intervening distances between the spark and the film, the details of the figure produced were somewhat blurred and indistinct. Subsequently, using very thin glass, this indistinctness was almost entirely eliminated.

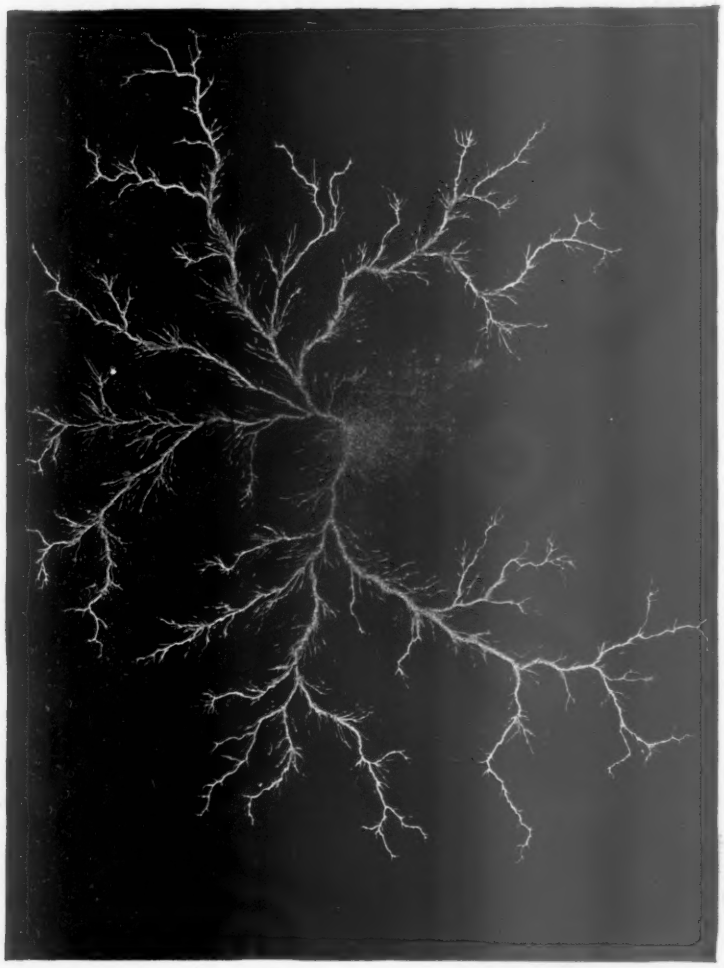


FIG. 1.—REPRODUCTION OF A PHOTOGRAPH OF A POSITIVE ELECTRIC DISCHARGE.

From these results it seems quite clear that the action is due to the ordinary photochemical effect of the light produced by the spark, which, though feeble in intensity to the eye, is blue, and must be remarkably actinic.

These experiments also go to prove that the general character of the positive and negative figures are not dependent upon the gelatine film of the photograph plate, but are invariable for insulating surfaces, such as glass and mica. That this is so is proved by the fact that although, by reason of the extreme relative brightness of the main arteries, it is very difficult to see the lesser emanations in the spark itself, still I have been able to catch a glimpse of those of both positive and negative characters by carefully watching the discharges over a plain sheet of glass in a perfectly dark room.

It is noticeable that while in the negative figures the main arteries show a decided tendency to form straight lines or sweeping curves, while the lesser emanations form very regular curves, diverging in frond-like form from the arteries, there is apparently no such tendency in the negative figures, which are entirely irregular.

In fact, while the negative figures point to something of the nature of momentum in the discharge, and give the idea of a stream issuing from the electrodes and splashing over the surface of the glass, positive figures, on the other hand, seem more nearly allied to streams flowing from the glass to the electrodes and drawing or sucking from all portions of the plate.

Another point to be noticed is the remarkable similarity between some of the figures and organic forms, such as some kind of seaweed in the case of the positive, and feathers or branches of palm leaves in the case of the negative. The figures, in fact, present another curious instance of the remarkable manner in which under favorable conditions inorganic matter will assume the structural forms generally associated with organic life.

Newspapers and Newspaper Men of New York.

The *Herald* is always distinct and different. The new uptown building will be exclusively used by it, and through the glass sides passers can see the mammoth printing presses, a sight unique and interesting. Another departure by the *Herald* is the publication on its editorial page every Sunday of a review of the political situation, from the gifted pen of Col. John A. Cockerill, accompanied by this forceful editor's picture. Every one interested in our politics, and that means a large majority of the *Herald's* readers, watches Col. Cockerill's articles with close interest. It is seldom that a great editor, with all the resources at his command, can be persuaded to give his knowledge of the political situation for publication over his autograph.

I saw Eli Perkins at the Fifth Avenue Hotel last week, yet a genial contemporary published yesterday an interesting letter from Shanghai signed by our brilliant but unreliable young friend.—*Howard in the Recorder.*

Yes. And when the versatile Howard went to Europe a year ago his "column," then published in the *Press*, appeared every day while he was on the ocean, and in it were discussed contemporaneous events! And the deep sea telephone is not working yet!

There are two papers in New York city that reporters are prouder to represent than any others, and these are the *Herald* and the *Sun*.

The New York *Tribune*, a republican journal of character, dignity and high ability, is said to be the best paying newspaper property—net profits considered—on Manhattan Island.

The event in newspaperdom of New York last week was the exposé by the *Sun* of the bogus cablegrams from Europe appearing in the *World*. It was the most complete and overwhelming feat of journalistic knocking out known to the history of the profession.

The *Mail and Express* is moving into its new and magnificent home, No. 203 Broadway, and has a right to be justly proud of its convenient and well arranged offices, probably the most perfect of any afternoon paper in the United States.

Mr. Ballard Smith has retired from the staff of the *World*, and it is reported will enter periodical literature. Mr. James F. Graham, formerly city editor of the *World*, afterwards managing editor of the *Commercial Advertiser*, where he was succeeded by the dashing and able Foster Coates, is said to be planning to bring out an uptown daily in New York city. Mr. Graham is an experienced and capable newspaper man, but what special demand he finds for an "uptown" daily is not evident yet in the discussions heard on newspaper row.

The editorial page of the *Morning Advertiser* is concededly the brightest and most entertaining in the city.

FIG. 2.—REPRODUCTION OF A PHOTOGRAPH OF A NEGATIVE ELECTRIC DISCHARGE.

A New Battery Zinc.

The d'Infreville wasteless zinc for gravity batteries which will be fully described in the next number of the REVIEW, is a good illustration of possibilities of improvement in the simplest and oldest types of electrical apparatus. The familiar crow foot zinc, of which M. d'Infreville is the original designer, has the very serious disadvantage of necessitating great waste as after the feet have been consumed the internal resistance of the cell becomes so great that a new zinc must be supplied. D'Infreville's invention permits the stub to be used so that every grain of zinc is rendered available for generation of current. Each zinc is provided with a central tapered post which is coned out underneath, forming a cup which prevents the entrance of liquid. When a zinc had been consumed to such a degree that the output of the battery is weakened, the post of the stub is forced into the socket of a fresh zinc, and the compound electrode thus formed is supported as before. The surface of contact is always clean, as the air in the cavity prevents the entrance of battery fluid. The support for the zinc is simple and efficient, dispensing with the necessity of binding posts or locking screws.

M. d'Infreville was formerly chief electrician of the Western Union Telegraph Company. This zinc is a clean and ingenious device and will be hailed with joy by those who have to handle gravity batteries. The compressed zinc lowers the internal resistance of a gravity cell to 0.7 ohm, the latter yielding about one ampere. A gravity battery equipped with these zincs may, therefore, be used in light motor work.

The inventor has issued an interesting descriptive circular showing in colors—quite a typographical achievement—a gravity battery containing one of his zincs.

Some Additional Notes on the Graphic Representation of Magnetic Fields.

READ BEFORE THE ELECTRICAL SECTION OF THE FRANKLIN INSTITUTE, JUNE 28, 1892, BY PROF. EDWIN J. HOUSTON.

In a paper read at the last meeting of the section, entitled "A Graphic Representation of the Magnetic Field," I described a process for readily fixing and reproducing the peculiarities of different magnetic fields, which consists essentially in forming the

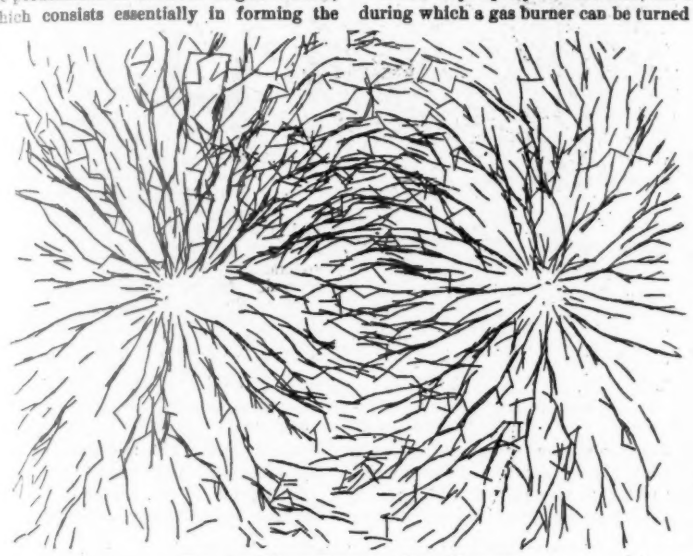


FIG. 1.—WIRE FIELD OF BAR MAGNET.

fields on wax covered plates, subsequently fixing the same by gently warming the wax, and employing the plate so prepared as a positive from which photographic prints can be readily obtained.

I also briefly described in the same paper a different process for the ready reproduction of such fields, in which the collections of filings are formed in the dark photographic room, directly on the sensitized surface of a plate, which is afterwards exposed for a few seconds to actinic light and subsequently developed, and promised a further description of this method at this meeting.

It will be readily seen that this process differs from the other, in that it produces photographic negatives, in place of the positives formed by the former process.

Since the last meeting of the section, I have experimented some little on the new

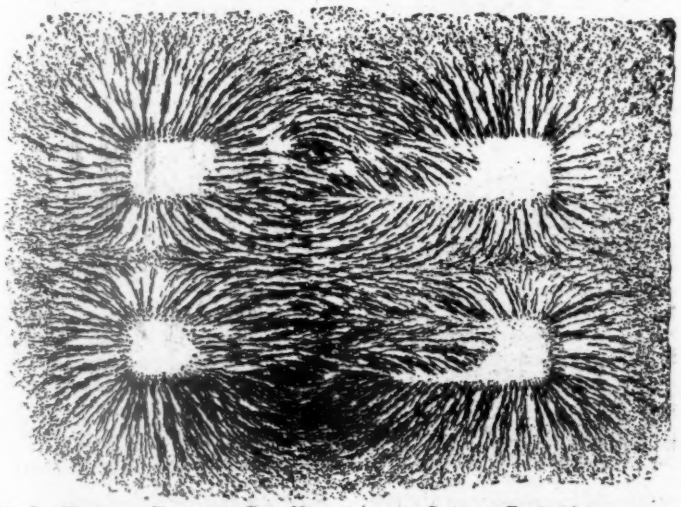


FIG. 3.—FIELD OF PARALLEL BAR MAGNETS WITH SIMILAR POLES APPROACHED.

process and have obtained very satisfactory results.

For the convenience of those who have neither read the former paper nor attended the meeting of the section at which it was read, I will describe the process in full, together with the details which are necessary in order to ensure the best results.

All actinic light being excluded from the dark room, and the red light being turned down as far as will permit the plate to be seen, when the eyes have become accustomed to the dim light, a sensitized gelatine plate is placed with its sensitized surface upwards on, or a short distance above, the magnet whose field is to be obtained. Iron filings or bits of wire are then carefully dusted over the sensitized surface, and obtained thereon, in characteristic groupings, by gently tapping the plate with a pencil or similar object in the usual manner.

The plate is then exposed to the light of a gas jet for a length of time, that will, of course, depend on the nature of the plate, its sensitometer number and the character of the effect it is desired to obtain.

When very rapid plates are used, the time during which a gas burner can be turned on and off is sufficient. I have, however, obtained the best results from the light of an ordinary friction match held above the plate and at a distance from it of about 12 feet. The match is lighted and immediately blown out. Even this short exposure appears to be greater than is required. With fairly slow plates I have found that an exposure of about three seconds, with a two-candle gas jet, at a distance of about four feet from the plate, gives excellent results.

The plate is then turned on edge so as to allow the filings to fall off its surface, and any dust that remains is carefully removed by a camel's-hair brush, and the plate is developed in the ordinary manner.

Since it is devised to obtain sharp contrasts of black and white, the best results are obtained by the use of bromides in the developer for the purpose of retarding the rapidity of development. After developing, the plate is treated for a few moments to an alum bath, and is then fixed in the hypo bath as usual.

Should the depth of the negative thus obtained be insufficient, the plate may be subjected to the action of a suitable intensifier. I have found a silver intensifier to give good results.

The specimens which I exhibit to-night were obtained either from Carbutt's or from Seed's gelatine plates.

In some of these experiments, Carbutt's plates, sensitometer No. 16, were exposed for about three seconds to the light of an ordinary gas burner, turned down to about two candles, and situated about five feet from the plate. From some experiments in this direction I am inclined to believe that the time of exposure under these circumstances can advantageously be considerably decreased. I employed for these plates the following developer:

No. 1. Water, 16 ounces; sulphite of soda, 307 grains; Para-amido-phenol, $76\frac{3}{10}$ grains.

No. 2. Water, 16 ounces; sulphite of soda, 307 grains; caustic soda, 280 grains.

Equal parts of No. 1 and 2 are mixed for use. For time exposure the above mixture is diluted with from two to four parts of water.

Any good developer, however, will answer.

I have also used Seed's plates, sensitometer No. 23. With these plates the momentary turning on and off of the gas jet gives a sufficiently long exposure.

I have also obtained very good results with Seed's plates sensitometer No. 26–x. With these plates my friend F. Gutekunst, of Philadelphia, has prepared some excellent fields.

In order to protect the plates from the light of the gas jet while lighting it, so as to avoid too long an exposure, the expedient was adopted of covering the plate with a developing dish until the light was turned on. It was then exposed while the dish was being rapidly removed from the plate, the gas being turned off when the dish was about one and one-half feet distant from the plate.

While myself out of the city and, therefore, away from my laboratory, my friend, Mr. F. R. Lefferts, of the Celluloid Company, of New York, kindly placed a photographic dark room at his cottage, at Belmar, N. J., at my disposal during these experiments. I am also indebted to him for valuable aid in preparing the photographic plates.

Fig. 1 shows the wire field of a straight bar magnet of steel. This corresponds to the bar magnet, the field of which was shown in the first paper on Fig. 10. This, like the other wire fields, was obtained by the use of short lengths of soft iron wire instead of iron filings.

Fig. 2 shows the filings field of a simple horseshoe magnet. The anomalous poles in this magnet show very peculiar groupings in the neighborhood of what was originally the neutral point of the magnet. These poles were probably caused by some unauthorized juvenile experiments I had not counted on being made.

Fig. 3 shows the field of two parallel

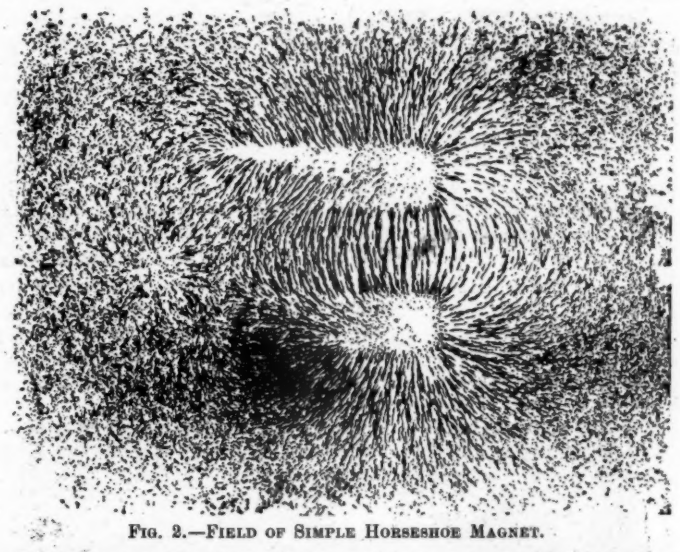


FIG. 2.—FIELD OF SIMPLE HORSESHOE MAGNET.

straight bar magnets with their similar poles approached. This figure corresponds to Fig. 5 of the first paper.

Fig. 4 shows the field of two parallel straight bar magnets with their dissimilar poles approached. This figure corresponds with Fig. 6 of the first paper. The conditions for the exposure of this field were more favorable than for most of the others, and the print shows what can be hoped for when the proper conditions necessary to ensure the best results are exactly understood.

Mr. Lefferts has kindly prepared for me an excellent transparency of this field, which I now show you.

Fig. 5 shows the field produced by the straight bar magnets placed with their axes at right angles to each other, and with their similar poles approached. The character-

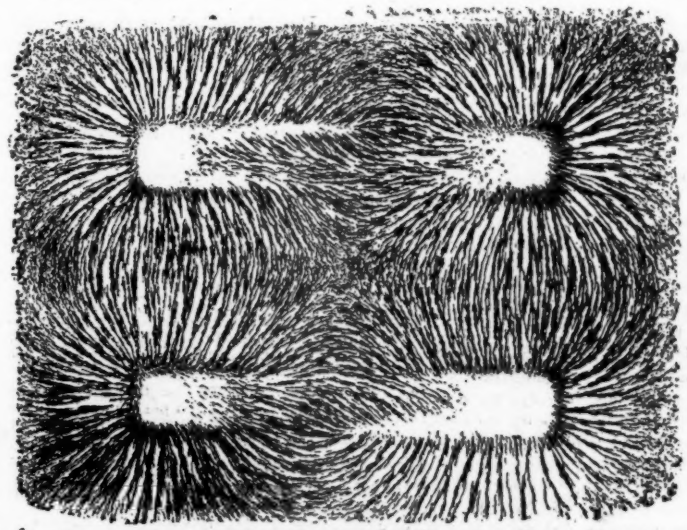


FIG. 4.—FIELD OF PARALLEL BAR MAGNETS WITH DISSIMILAR POLES APPROACHED.

istic parallel streamings produced by the repulsion of similar lines of magnetized particles are clearly shown.

Fig. 6 shows the field produced by the straight bar magnets with their axes at right angles to each other and with their dissimilar poles approached.

Fig. 7 shows the field of the two straight bar magnets placed with their axes at right angles to each other, and the pole of one near, but not in contact with, the neutral point of the other. This corresponds to Fig. 4 of the first paper.

Fig. 8 shows the filings field of a com-

pound permanent horseshoe magnet. This figure corresponds with Fig. 7 of the first paper.

Fig. 9 shows a curious field of the same

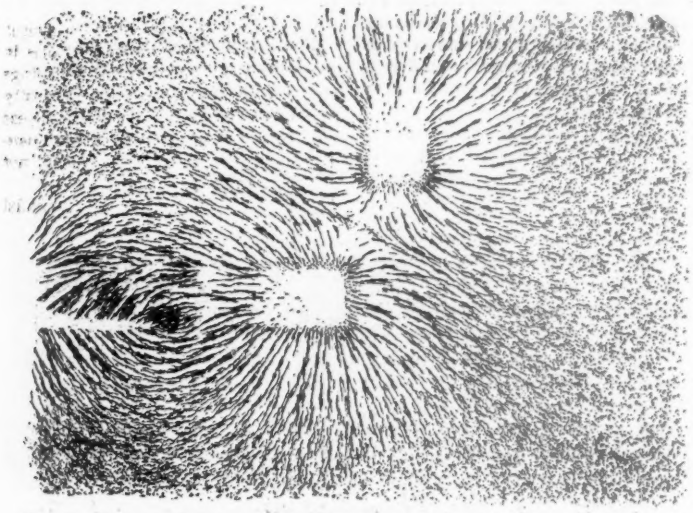


FIG. 5.—FIELD OF STRAIGHT BAR MAGNETS WITH AXES AT RIGHT ANGLES AND SIMILAR POLES APPROACHED.

permanent horseshoe magnet shown in the former paper in Fig. 9. In this figure, however, the magnet is placed with its axis in a

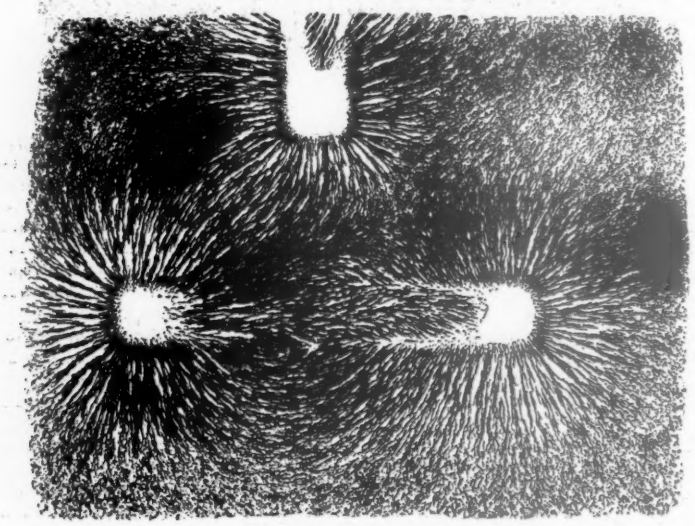


FIG. 7.—FIELD OF STRAIGHT BAR MAGNETS WITH ONE MAGNET NEAR NEUTRAL POINT OF THE OTHER.

horizontal position, while in the figure of the first paper it was placed in a vertical position. I have reproduced Fig. 9 of former

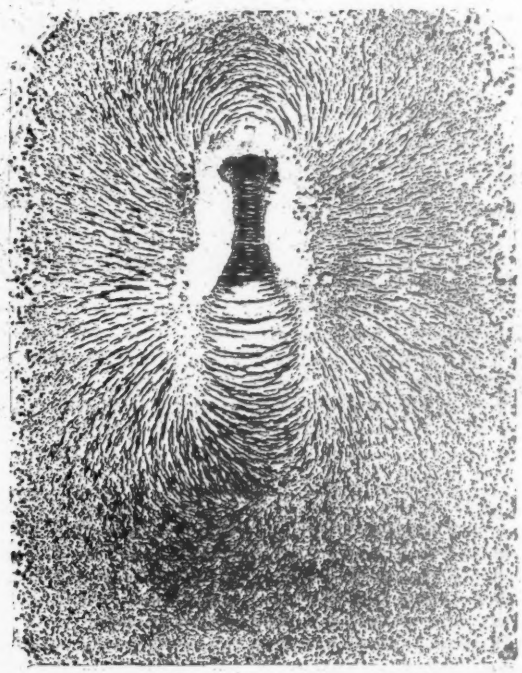


FIG. 9.—FIELD OF HORSESHOE MAGNET WITH LONGER AXIS HORIZONTAL TO PLATE.

paper in Fig. 10 for ready comparison. The leakage, in planes at right angles, is well shown. The magnetic leakage in this case gives the curious appearance of a "beatified bottle."

I also show you a number of aristotypes prepared for me by Mr. Lefferts. I have also formed some curious compound fields with filings and wire mixed. Figs. 11 and 12 show such fields, corresponding to Figs. 3 and 4, as shown above.

—— Nearly every newspaper of note now prints a column or more of electrical notes.

Boiler Pitting Cured by Graphite and Oil.

In the *American Machinist* of July 28, Mr. T. T. Parker has a very interesting column article regarding pitting in boilers. Besides some clever theories, he has this to say from a practical point of view: "A boiler of the porcupine persuasion pitting was found in the mud drum. Acting under advice, the drum was cleaned and scraped, after which it was painted with graphite mixed with cylinder oil. Measurements of the depths of the pits were taken, and six months after they were found no deeper, and no new ones had shown up. Other parties have since tried this experiment in mud drums, but it is too early as yet to give the result. However, knowing the character of plumbago, if the interior of a boiler could be painted with it in such a way that it would stay, it may be this would prove a remedy. I am satisfied also that the person doing so would kill two birds with one stone, as the scale could be easily detached. In a pair of cylindrical boilers 42x28 occasional applications of cylinder oil (mineral) and plumbago has kept back corrosion on a trial of six months. Boilers were new when plumbago was used. The boilers which the new ones replaced were thrown out rotten from corrosion. The feed was mine water, as nothing else could be had."

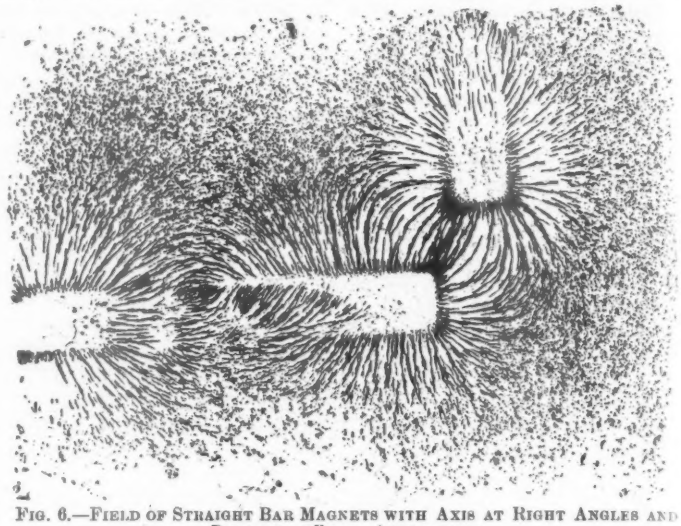


FIG. 6.—FIELD OF STRAIGHT BAR MAGNETS WITH AXIS AT RIGHT ANGLES AND DISSIMILAR POLES APPROACHED.

In addition to Mr. Parker's remarks we add that, Messrs. Harig, Koop & Company, Louisville, Ky., after experiencing more or less trouble from rust and scale in the mud drums of their boilers, applied with great success graphited oil, purchased from the Joseph Dixon Crucible Company, Jersey City. The mud drums were cleaned out and the graphited oil applied with swab, brush or anything handy, to the joints and parts where the water enters the drums. Every four or six weeks this process is repeated with the most gratifying results.

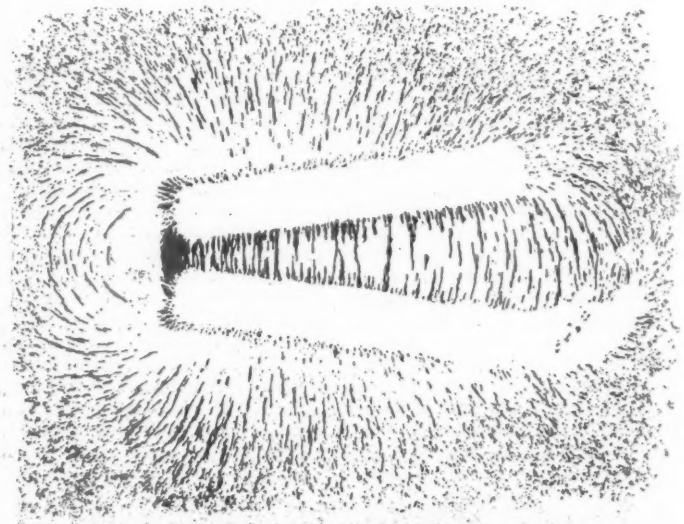


FIG. 8.—FILINGS FIELD OF SIMPLE HORSESHOE MAGNET.

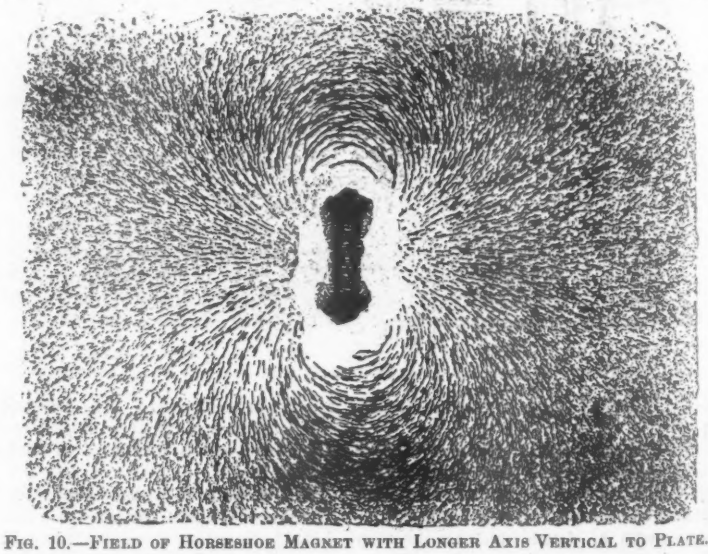
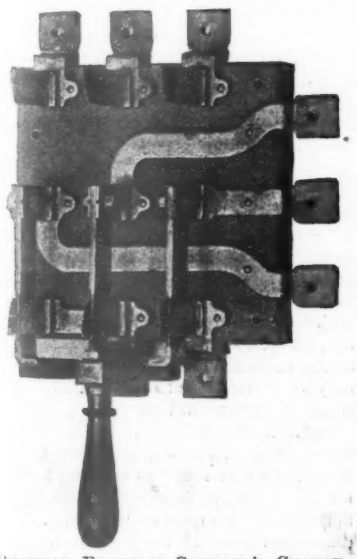


FIG. 10.—FIELD OF HORSESHOE MAGNET WITH LONGER AXIS VERTICAL TO PLATE.

General Electric Company's Change-Over Switch.

To meet a demand created by the increasing adoption of electricity for lighting purposes, the switch shown in the cut on this page has been devised by the General Electric Company. This is constructed for use as a main switch on installations provided with independent or isolated dynamos and at the same time connected with the street service.

The switch is mounted upon a slate base. Three connecting wires are arranged cross-wise between the two sets of side contact clips. To these bars are hinged three switch blades, having a common handle, which can be thrown into either set of contact clips. Two of the clips on one side are connected together, and it is on this side that connection is made with the main wires of the isolated plant, which must be wired according to the three wire system. It is necessary that the neutral wire which is brought to the central connecting bar of the switch should be of larger sectional area than usual. When the lights are being run from their own isolated plant the neutral wire acts as the positive conductor, the two outside wires



General Electric Company's Change-Over Switch.

serving as the negative. Thus, when the isolated plant is shut down and the street service thrown on, the building is lighted by a true three wire system.

The advantageous uses to which this switch can be put are numerous. In factories having isolated electric plants, the operation of the boilers, engines and dynamos after whistle-blow, when part of the force is working overtime, would be extremely costly. Connection with the street service is therefore made, the switch illustrated thrown over from the isolated services and the factory lighted on an economical basis. The switch can also be used as an emergency or break-down switch in case of injury to the isolated plant. In theatres and other public institutions, where a sudden extinction of light would inevitably cause a panic, it is a moment's work only to switch on the current from the street and avert disaster.

Sources of Danger in Electrical Risks.

The controversy over electrical risks is peculiar in that it entirely ignores the real seat of the danger. In almost every article that has been written upon the subject, the fires are said to be due to unskilful wiring, and much stress has been laid upon heedless workmen, cut rates and improper insulation. Now, as a matter of fact, the danger lies not so much from the side of the wire as from its terminus. The workmen employed in wiring buildings are better educated and more intelligent than almost any class of laborers, and they generally do use proper care. The danger proceeds from the fact that telephones, electric clocks and incandescent light apparatus are constructed to receive and dispose of a moderate current and not of a heavy one that may be switched upon them at any moment by contact with an arc light or fire alarm wire.

When a plant is isolated, as in a factory, it is comparatively easy to take care of it. The Boston Manufacturers' Mutual adopted some simple rules for protection in 1881. In five months there were 23 fires in the 65 plants insured. A closer enforcement of the rules was followed by entire immunity from fires for 10 years. Last year there was a loss of $1,000, consequent upon the dampening of a switchboard by escaping steam.

With proper precautions electricity is the safest lighting agent. Without precautions it is in a high degree dangerous. Two of the most important rules insisted upon by Mr. Atkinson's company are worth repeating again here:

"If any wires carrying high tension or strong currents are to be carried over or under other wires on the property of the insured, they shall be attached to poles so near to each other, with one wire so far above the other, that if a break should occur, the pendant wire between these poles may not be long enough to come in contact with the wire below, or, if not carried on poles, these wires shall be so placed or protected with guard-wires as to render a contact between different wires impossible.

"If the high and low tension systems are in use in the same yard, even when developed within the works, the wires must be kept separate, and so wide apart that no contact or cross arc can be made."

An important source of danger in Boston is shortly to be plugged. The fire alarm wires are run by a mass of batteries in the attic of City Hall, which is perhaps the most dangerous spot in the city. Mr. B. S. Flanders, the superintendent, is authority for the statement that the fire alarm wires are shortly to be run by dynamos similar to those furnishing the electric light currents. The crossing by these wires, therefore, will be simply the meeting, as it were, of friends, and not as productive of danger as at present.

The big Bedford street fire was almost certainly caused by ignition from an electric clock. The number of these is not increasing and we have heard of no device to protect the clock from burning out when accidental contact with a strong current by its wire sends a too powerful charge of electricity into its very vitals.

Telephones are now, however, most amply protected. Mr. C. J. H. Woodbury, at Cornell last Fall, described the devices in use as follows:

First, the ordinary serrated lightning arrester, which is generally able to protect the system by reason of the extent to which the lightning is divided by the numerous wires in its course, and, as has been mentioned before, this lightning is very often inductive in its nature rather than a direct stroke.

Second, the telephones are protected against currents originating from incandescent lighting or power circuits by means of pieces of easily fusible wire about four inches in length inserted in the line of the telephone system. These wires are enclosed in glass tubes, not merely to protect them from injury, but also to prevent any damage being caused by the hot metal of the fuse igniting anything when it is thrown about by the explosive violence which occurs whenever a heavy current melts it.

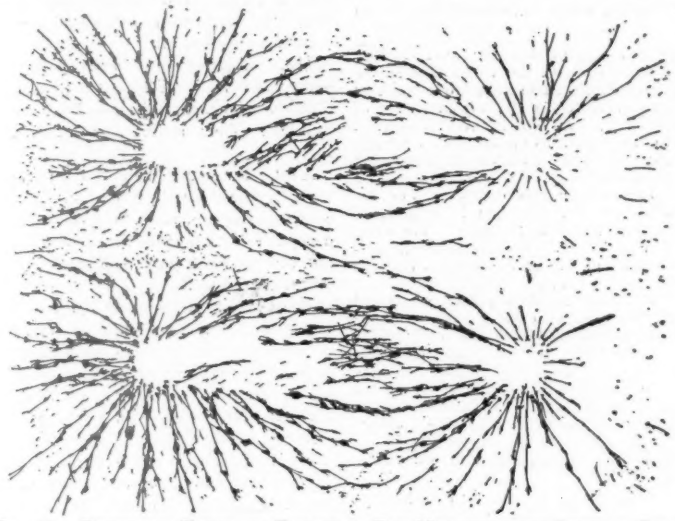


Fig. 11.—Compound Field of Parallel Bar Magnets with Similar Poles Approached.

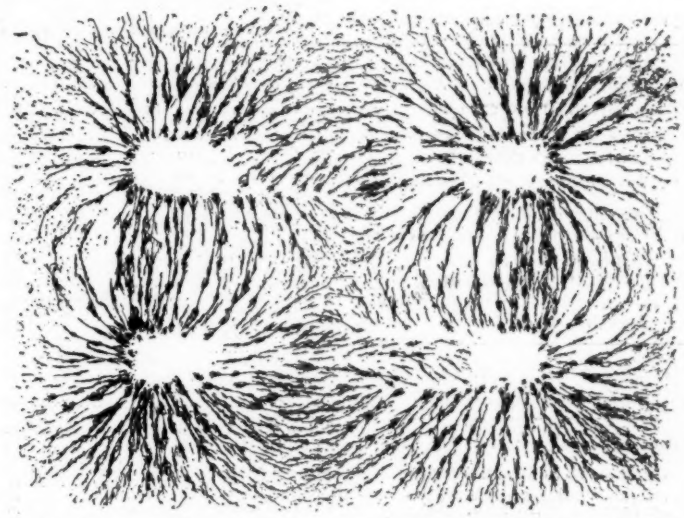


Fig. 12.—Compound Field of Parallel Bar Magnets with Dissimilar Poles Approached.

A similar device consists of a strip of tinfoil rolled up with asbestos paper and forming a part of the circuit, the tinfoil being instantly vaporized by an abnormal current.

Third, for protection against the currents preceding from arc lighting apparatus and those used for the transmission of power, particularly the overhead trolley system, the most efficient means has been the air cut-out, consisting of two pieces of gas carbon separated a very short distance by means of a thin film of mica containing perforations. One of these pieces of carbon is connected to the earth and the other forms a part of the circuit. Whenever a current on a grounded circuit, having a tension of about 350 volts, passes along the telephone circuit, it leaps the narrow space separating the two carbons and, forming a very short arc, continues to the ground. Small bits of easily fusible metal are inserted in holes in the carbon, and, if the current is maintained for any particular length of time, the metal becomes melted and establishes a conductor of low resistance to the earth. A film cut-out can be used for the same purpose, but in this case is not quite so suitable because of the necessity of readjustment in every instance where it is called into operation.

Fourth, another class of accidents are those arising from a cause more difficult to manage, and that is what is known as sneak currents, being generally foreign currents connected with the system by something serving as a shunt of high resistance, so that the currents are very small, but yet enough to injure the electro-magnets and also to cause fire when they are maintained for a long time; for it should be remembered that the insulating material upon the wires used in electrical apparatus is also a non-conductor of heat, and it is not possible for them safely to conduct as great currents as if they were not covered with insulation and were exposed to the air, allowing the heat to pass off by radiation instead of becoming cumulative.

The only form of apparatus which has thus far controlled these sneak currents is simply a ball, principally composed of wax and nearly half an inch in diameter, held against the electro-magnet by a strip of spring metal. Whenever the electro-magnet becomes warm this ball softens, and the movement of the spring operates a switch which shunts the telephonic apparatus out of circuit.

As to insulation, care should be taken in damp places to run the wires on insulators and not against the wall. Insulating tubing should be used when passing through a partition. Exposed wires are safer than when behind mouldings.

The multiplication of wires in large cities needs some governmental control out of consideration for the public safety, especially as the careless corporation in this case damages not merely itself but its neighbors.

Why is it not feasible to put a general supervision of all wires into the hands of Mr. B. S. Flanders, for instance, who has charge of the city's fire alarm wires?—*Boston Commercial Bulletin.*

New York Electric Club.

After being closed for nearly six months, the café of the Electric Club was re-opened this week. Arrangements have been made with Mr. W. V. Carter, a caterer, to supply members and their friends with meals, wines, liquors and cigars, in quality and style of service equal to those of the best days of the Club. It is proposed to increase the lodging facilities of the Club house to such an extent, that members who neglect to engage accommodations in advance can be provided for.

The board of managers have succeeded in liquidating nearly the whole of the Club debt, and it is hoped that a proper patronage will be given to the Club service from now on. There is no pleasanter, better equipped or more conveniently located club house among the smaller clubs of New York than that of the Electric Club.

Pitman's "Water Dynamo."

The engraving given herewith represents a general view of a "Demon" water motor driving a dynamo direct, as made by Mr. P. Pitman, Aubrey Road, Withington, Manchester. The illustration is reproduced from London *Industries*. The combined motor, capable of indicating two brake horse-power and dynamo is especially intended for domestic purposes, a pressure of water equal to

Pitman's Water Dynamo.

60 pounds per square inch being recommended. As will be seen, the motor and dynamo are mounted upon one bed-plate. Should, however, the motor be required for other purposes than driving the dynamo, the latter can be instantly disconnected by means of a clutch, and a belt can be run from the pulley on the other side of the motor to any machine which it is required to drive. The governor, we are informed, is extremely sensitive, putting on or throwing off the load making scarcely any appreciable difference in the speed of the motor. To reduce the speed the governor does not throttle the water, but simply reduces the size of the ports through which the water enters. These motors are made to work with a pressure of water as low as 10 pounds per square inch and are guaranteed to give an efficiency of 80 per cent.

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Mayor Grant is not so much of a politician but that he can see that which is the greatest benefit to the greatest number. Hence his approval of the introduction of the trolley into New York city.

The "Letters From a Laboratory," published in the REVIEW each week, are attracting much favorable interest. A particularly interesting one appears in this issue. Mr. Moses is giving the readers of the REVIEW the benefit of his own personal experience in a practical, entertaining manner.

And now the training of a prize fighter calls for the use of electrical apparatus. Dr. Sargent, the physical director of Harvard University, has devised an electrical machine which shows the speed of Sullivan's fist. If the fist left the arm and kept on traveling it would make a mile in about three minutes.

Some one proposes to annex Baltimore to Washington by constructing between the two cities a boulevard and an electric railroad 40 miles long, which would soon be lined with suburban residences. But the Baltimore people retort that this would result in annexing Washington to Baltimore.—*Philadelphia Telegraph.*

A man leaned too far out on a trolley car, struck a passing car and was badly hurt. The daily press announced another accident due to "the deadly trolley." On this theory the trolley is expected to furnish brains to every passenger. If it could, what a rush for seats there ought to be on the part of these ignorant writers.

THE TROLLEY IN THE ANNEXED DISTRICT.

The trolley system is slowly gaining a foothold in this city. On August 26, Mayor Grant signed the ordinance previously adopted by the Board of Aldermen granting to the Union Railway Company, better known as the Huckleberry road, the right to construct extensions to its tracks in the annexed district, and to use any motive power other than steam. In other words, it gives this company permission to use the trolley system.

In signing this ordinance Mayor Grant says:

"In approving of this act I do so feeling that it is in line with the views that I have previously expressed on the use of electricity for street railroads in the district north of the Harlem River. The Board of Electrical Control discussed this matter some time ago and decided that it was advisable to sanction the use of electricity as a motive power on street railroads in this district. The annexed district is very much in need of increased rapid transit facilities. The comments of the property owners along the proposed routes of the new road show that the people favor the trolley system.

"The opposition that has been expressed toward it appears to come from rival corporations rather than from the residents of the Twenty-third and Twenty-fourth Wards. Real Estate Exchange brokers are now asking and obtaining much better prices for land in this district in anticipation of the introduction of the new road. This, I think, is a good indication of the feeling of the people in the annexed district toward the new road."

Referring to the opposition to the trolley, Mayor Grant has hit the keynote when he declares that the opposition does not come from property owners. There is really but one direction in which New York city can grow and that is northwardly into Westchester County. The trolley system will be of the greatest benefit in developing this district and real estate values will take a great jump upward in consequence.

THE ELECTRIC LIGHT FOR CAMPAIGN PURPOSES.

The time-honored oil torch-light of former presidential campaign parades is likely to be superseded this year by the electric torch. Orders amounting to several thousand dollars have already been placed with electrical supply houses throughout the country for electric torches, lanterns and helmets, and inquiries are constantly coming in. The bad-smelling and dangerous oil torch must give way to modern inventive genius, and electricity steps to the front to supply the need. There are several companies manufacturing electric light specialties which can be easily transformed into ornamental devices suitable for parade purposes. Some of these are fed by current from storage batteries and others from a primary source. The electric light has been used to a considerable extent for decorative effects during processions and parades at night, but its possibilities in this direction are practically unlimited. We may see portable dynamo plants supplying currents to the paraders who can be put through evolutions producing beautiful designs and figures of vari-colored lights, forming a novel and interesting feature of a night march. The managers of campaign clubs can secure valuable information relating to this subject from some of our metropolitan theatrical managers who are familar with the uses of the electric light in spectacular productions.

Mr. Edison was recently asked by a reporter for the New York *Press* how the electric novel which he was reported to be writing was coming on. "Oh, that's off," he said, and he told the truth. The novel was to be written in collaboration with George Parsons Lathrop. Edison was to furnish the electrical suggestions, Lathrop the plot and to do the literary work. Edison was all enthusiasm at first, and Lathrop had five or six interviews with him, in which Edison poured out suggestions faster than Lathrop could assimilate them. Then Edison's enthusiasm cooled. He tired of the whole thing and would have nothing more to do with it, leaving Lathrop in the lurch with a novel about half done. Edison declares that there is no fiction in electricity.

LETTERS FROM A LABORATORY.—X.

BY JULIAN A. MOSES.

A rather ingenious fraud recently came to my notice. Advertisements appeared in a number of the smaller country papers, describing the wonderful electric properties of a lately discovered mineral spring. It was guaranteed "to cure every disease under the sun"; and the company paid experts (?) to give evidence in favor of the virtue of the spring. The wonderful part of the spring was, that when one drank of its waters the usual "gentle flow of electricity" was felt, "bringing relief to all."

This advertisement naturally brought scores to the little one-horse village that was thus being boomed, and corner lots advanced in prices. The place bid fair to rival Saratoga.

A little investigation showed the arrangement to be very unique in its way. The company was, of course, to be blamed for its deception, but the air of the place was bracing, the water was pure, and those who came sick, returned well.

The directors of the company grew richer day by day, until finally the cat was let out of the bag when the usual disclosures were made. The public showed itself ungrateful for the numerous benefits received, and claimed that it had been swindled. The directors asserted that the faith cure was a part of the treatment, and if people would not believe, that was not the company's fault.

The wonderful "electric spring" was arranged as follows:

It was but a plain mineral spring, but the cups that the patients drank from were fastened by a brass chain to an iron bar which enclosed the mouth of the bubbling spring. You were prevented from coming too close by another circular iron railing, about 8 feet across. The ground around the spring was naturally moist and it was either this ground or the iron railing which was one of the ends of an open electrical circuit. The cup held by the chain was the other end. The person drinking, simply completed the circuit through his body and when he had finished, the attendant kindly and immediately removed the cup from his hand. The drinkers always felt that "delightful tingling sensation," and rejoiced that they had found the fountain of youth. Some imagined they even felt the new blood coursing through their veins. A small induction coil ingeniously concealed, and connected with the cup and railing, was a cheap method for producing that "invigorating feeling."

OBITUARY.

Mr. John K. Dunbar, general superintendent of the Southwestern Telephone and Telegraph Company, died at Buffalo Lithia Springs, Virginia, on Tuesday, August 16, in his forty-fourth year. His connection with the Southwestern company dated from the year 1881, when the company was formed, and he succeeded to the general superintendency on the retirement of Mr. J. N. Keller from that position in 1883.

Mr. Dunbar had been ill for some time, the result of a severe attack of the grip last winter, and after a visit to the East, to seek medical advice, he had gone to the Lithia Springs to try the effect of the waters. Encouraging reports of his progress towards recovery had been received here up to within three days of his death, and the news of this sad occurrence has caused a feeling of genuine sorrow in this community, where he was held in the highest esteem.

Probably no man occupying a similar position was ever held in more affectionate regard by his subordinates than Mr. Dunbar. Of unassuming and kindly ways, he was easily approached by the humblest, who was always assured of a patient hearing. To these, and all of his associates in the company of which he was an officer, his death will be felt as a personal and deep bereavement.

A devoted husband and father, his death comes with peculiarly crushing effect upon his widow and two interesting daughters, one 15, the other 10 years of age. To them every heart must go out in tenderest sympathy in this time of their distress and grief.

Mr. Dunbar's remains were temporarily interred in Virginia. K.

Austin, Tex., Aug. 20, 1892.

CORRESPONDENCE.

OUR BOSTON LETTER.

The **Economical Feed-Water Heater Company**, of Guilford, Conn., has been incorporated with a capital of $50,000.

Mr. L. Cofren, the genial traveling representative of the Washburn & Moen Manufacturing Company, favored this office with a call on Friday.

The **Hines Safety Fender** for electric cars was successfully experimented with yesterday (Friday) afternoon at the West End railway power house on Harrison avenue.

Vice-president C. J. H. Woodbury, of the Boston Manufacturers' Mutual Insurance Company, is absent on a short business trip through Rhode Island, Connecticut and New York.

Mr. C. A. Coffin, of the General Electric Company, took passage on one of the Cunard line steamers, leaving New York this week, and will visit several of his company's European offices during a month's tour abroad.

The **Pacific Mills of Lawrence, Mass.**, which have the largest electric light plant of any mill in New England, has recently made an addition of 2,500 lights to its equipment. This makes the total number of electric lights over 7,000.

The **Lynn and Boston Street Railway** (electric) has a special meeting on Tuesday at its offices in this city, and the following well-known gentlemen were added to its board of directors: Capt. Eugene Griffin, J. P. Ilsley and E. E. Denniston.

Sad News.—The friends and acquaintances of Mr. Stephen E. Barton will be grieved to learn that on account of his poor health it became necessary to resign the secretaryship of the Lancashire General Insurance Company's American Department.

Mr. E. H. Booth, of the Boston office of the General Electric Company, in company with the engineer of the Northwest General Electric Company, of St. Paul, has gone to Montana, to look up the prospects for mining by electricity in that State. From there both will proceed to the Pacific coast on the same mission.

The **Springfield, Chicopee and Glenwood Electric Railway**, the new branch line of the Springfield Street Railway Company, was in operation Tuesday evening, August 23, the first car leaving Chicopee at six o'clock. This completes through connection between Springfield and Chicopee *via* Glenwood, Chicopee Falls and Chicopee Center.

Messrs. Smith & Wallace, respectively the ex-treasurer and the manager of electric railway supply department of the Eastern Electric Supply Company, of this city, have formed a co-partnership and will sell supplies for equipping and operating electric railways. The firm have leased commodious offices and salerooms at No. 8 Oliver street.

Newton and Boston Street Railway (electric) starts its first car on Monday next to the following places between the cities named: Newtonville, Newton Center, Newton Highlands, Newton Upper Falls. The line east from Newton will soon be completed to Chestnut Hill, where it will connect with the electric line now in operation.

Loss by Fire Almost Nothing.—The Boston *Commercial Bulletin*, of August 27, contains the following correction: The only loss sustained in 10 years by the Boston Manufacturers' Mutual from an electric fire, since they insisted upon their rules for care of electric plants, was of $1,000—not $1,000,000, as altered from the manuscript by the compositor in this column last week.

The **New Railroad Station** of the Concord, N. H., and Montreal Railroad Company, at Laconia, N. H., has just been equipped with one of the best electric light equipments in northern New Hampshire. The station, which has only recently been finished, is a very pretty one, being built of granite. The electrical equipment will consist of 100 incandescent and two arc lights. From the main dome will hang two electroliers of 30 lights each. The remainder of the incandescents will be arranged in groups of 6, 8 and 10 lights. W. I. B.

Boston, August 27.

OUR CHICAGO LETTER.

John Nunan was in the city this week and purchased a 200 light plant of the Crocker-Wheeler Electric Company for the Bayonquet Lumber Company, of Mama, Michigan.

Mr. Hayward Cochrane, who has been connected with the Elektron Manufacturing Company for the past two years, has just left for Denver, where he will represent the same company.

A. A. Forman, Manager of the Iron Mountain Electric Light and Power Company, was in the city this week, and purchased a 350 light plant of the Crocker-Wheeler Electric Company, for the Marinette Lumber Company, Marinette, Wis.

The **Enterprise Electric Company** report orders for N. I. R. wire steadily increasing, and on account of the big demand found it impossible to keep much stock on hand. They have several orders unfilled on hand awaiting shipment of wire from factory.

The Central Electric Company's sales for Gladiator dry batteries have been so large for the past few weeks that their stock is completely exhausted. They are, however, receiving a large consignment and will be in position to again fill their orders promptly.

The Detroit Electrical Works, through their Chicago office, has closed contract with the Delta Electric Railway, of Cairo, Ill., to furnish five 30 horse-power motor equipments complete together with overhead construction for five miles of road and arrangements are being made to commence work at once.

Among the Many Large buildings which have recently been wired with Okonite wire the Central Electric Company report having secured the St. Charles Hotel, which will be furnished with 1,100 lights, Okonite being used throughout. This insulation was decided upon in the face of the fact that the prices were considerably higher than those of other grades of rubber wire. They also report that the 10 story Lakota building in this city is to be wired throughout with Okonite. Interior conduit will also be used. They also report having secured an order for some 10 miles of No. 6 Acme lead covered cable, tested for 1,000 volt circuit.

Siemens & Halske.—The Pabst Brewing Company, of Milwaukee, Wis., have placed their order with Siemens & Halske Electric Company, of America, for their new 10,000 light incandescent central station. This installation will consist at first of two 250 horse-power dynamos and one 90 horse-power dynamo of the well known Siemens & Halske direct coupled type. The armature being placed on the end of the shaft. The Lake Erie Engineering Works have secured the order for engines. The ultimate capacity for this plant will be in the neighborhood of 40,000 lights, and by means of the Siemens & Halske generators and the Lake Erie engines the space occupied will be very small.

Chicago, August 27. M. J. B.

Niagara Falls Power Scheme.

Prof. George Forbes, the electrical engineer, and Prof. W. C. Unwin, the hydraulic engineer, both of London, met with the Cateract Construction Company, at Niagara Falls, last week, to discuss the ways and means pertaining to the two great power projects—one on each side of the Niagara river. The proposed construction of the Canadian Tunnel was given definite form by Prof. Unwin being given authority to prepare plans for it. The tunnel will be only 800 feet long, and it can therefore be driven in a comparatively short time. The transmission question was taken up. It is purposed when the two tunnels are finished to have the transmitting system connected, so that in the event of a breakdown of either dynamo the other may prevent any interruption of the electrical current, which, it is expected, will run great manufacturing establishments, street cars, etc., in the city of Buffalo.

Professor Forbes and Professor Unwin are both Fellows of the Royal Society, and each is eminent authority in his particular science in England. They have given considerable time to the subject of the size of and the nature of the electrical apparatus which it has been left for Professor Forbes to arrange. Transmission will take place backward and forward across the river and on both sides of the river, preferably on the Canadian side, by reason of it being a shorter route to Buffalo. It is not expected that any of the power of the present tunnel will be transmitted until the Canadian tunnel is completed, as the latter work will not require the length of time consumed in the construction of the present one.

An Immense Engine Contract.

What is said to be the largest contract for stationary engines ever awarded in the world has just been secured by the Edward P. Allis Company, of Milwaukee. The contract calls for 14 immense engines, with an aggregate of 20,000 horse power, to be used by a Brooklyn street railway company, in its new electric power station. The engines will cost $440,000. In addition the Allis Company will make a number of heavy castings, at a cost of from $80,000 to $90,000 for the Brooklyn railway, so that the total work involves considerably more than half a million dollars.

THE TROLLEY QUESTION.

The Broadside Last Week from the "Electrical Review" Attracts General Attention from the Daily Press—Appreciation at the Hands of Distinguished Editors who Had not Previously Considered the Merits of the Trolley.

A FEW COMMENTS OF THE PRESS GIVEN BELOW.

The editorial headed "Anti-Trolley Humbug" in the ELECTRICAL REVIEW for August 27, has stirred up the editors of the daily press to a careful consideration of the trolley question. Our views in the matter seem to have struck the chord of truth and have been appreciated by our friends on the daily newspapers. We are right on this question and propose to do what we can to secure proper consideration for the trolley system.

"Contains a Good Deal of Common Sense."

[From the *Sunday Sun*.]

We reprint elsewhere, from the ELECTRICAL REVIEW, an article on the trolley system, which appears to us to contain a good deal of common sense. We have had no sympathy with the widespread condemnation by the newspapers of the trolley, because it seemed to us to be mainly rhetorical and to lack scientific and practical substance.

We have always held that there was only one sound and serious objection to taking a current of high voltage from overhead wires in a city, and that was, that in case of fires it would probably seriously interfere with the work of the firemen. We must admit, however, that it would be a very simple affair to introduce a device whereby the firemen could control or ground the current at any point where it threatened to affect their operations. Our elevated rail roads are sometimes brought to a standstill by the firemen occupying the tracks with hose, but the trolley lines need not necessarily be stopped in their entire length, since it should be a simple thing to divert the current, let it make a detour and return to the main line at a point where it would not interfere with the firemen.

There has been a great deal of dishonesty and nonsense in what some newspapers have printed about the trolley system.

Accidents on Trolley Roads Magnified.

[From the New York *Press*.]

Commissioner of Electrical Control Theodore Moss declares that there is a good deal of senseless clamor against the trolley. "Why," said he, yesterday, "the trolley will increase property valuations 25 per cent. in the annexed district. They want means of transportation there, and the trolley system would give this and would make a great boom in that part of the city. I can see no harm in stringing the trolley wires under the 'L' road. They would do no harm. As to the question of authority for so doing, the corporation counsel's opinion would be asked on that matter. No application has yet been made to us for the use of the 'L' structure in Columbus avenue for the purpose. The number of accidents from the trolley is not so large as from the horse cars. Accidents on the latter are not magnified as on the trolley roads."

Sensible Writing About the Trolley.

[From the New Bedford, Mass., *Mercury*.]

We read in the papers about "the deadly trolley," coupled with many recommendations of the storage battery system and confident predictions that the battery will soon supplant the dreaded wire and pole. And yet, most of the accidents which are reported as due to electric cars might as easily happen with the storage battery as with the trolley. It very rarely happens that a mishap arises from the electricity with which the wire is charged; most of the accidents are of collisions; of running over people, usually children; and of passengers falling under the car wheels. Given carelessness on the part of street car companies and the public, and these accidents will happen with any system. There are many reasons why the public will prefer the storage battery system, if it can be made to work successfully. But no sane man believes that there will be no accidents after its adoption.

Newspapers Should Study the Electric Motor.

[Howard in the *Recorder*.]

If it be a fact, as the ELECTRICAL REVIEW says, that conservative business men have invested nearly $200,000,000 in electric railways in this country alone, would it not be wise for newspaper writers to read and study thoroughly the subject of electric motors? Much is written about it which is absurd, much that is insincere, much that appeals to popular prejudice. Every one knows we need a new motor. It is to the public's interest, as well as to that of capital, that the best be secured.

The McKinley Tariff and Submarine Cables.

TO THE EDITOR OF ELECTRICAL REVIEW:

The following, clipped from the *Electrical Engineer* of August 24, page 177, is a good sample of free trade *truth*, *logic* and *arithmetic*:

IMPORTING SUBMARINE CABLE.

Under the new McKinley tariff law, importations by the United States Government are no longer free of duty. As the result of these changed conditions, Prof. Harrington, chief of the Weather Bureau, informs the Secretary of the Interior that the cost of the cable for two proposed weather signal stations on islands in Lake Huron is doubled. His original estimate of the cost of seven miles of cable was $10,500 or $1,500 per mile, but he now wants $21,000 or $3,000 to meet the additional cost on account of the duty.

The duty on submarine cables was not changed by the McKinley bill. It is and was 35 per cent. *ad valorem*. How this can double the cost is a problem which free trade arithmetic alone can solve. The McKinley bill requires the government to pay the same duty as its citizens and corporations by whom the government is supported; but there is a very material difference when the individual or corporation imports the cable and pays the duty; the 35 per cent. is gone from the purchaser; but when the government imports and pays the duty it pays the 35 per cent. to itself and is no poorer by the operation. Or, if perchance, this additional price forced upon all purchasers compels the government as well as others to buy at home, then the money all goes to the laborers and capitalists of this country and helps them to bear its terrible (?) taxes, and the government can console itself as did the young man whose bank account was seriously lowered by a present to his best girl, when he said to himself, "Never mind, I will soon have that present back and the girl with it." As to the figures given as estimates, I will say that the first estimate is nearly three times as much as the life saving service pays for similar cables of domestic manufacture, and I think there are at least three companies in this country who would be glad to make and lay for Professor Harrington his seven miles of cable for less than $10,000. Yours truly,

HENRY A. REED.

New York, August 25, 1892.

PERSONAL.

Mr. W. C. Rinearson has been appointed general traveling passenger agent of the Chicago Great Western Railway, with offices in the Phœnix building, Chicago.

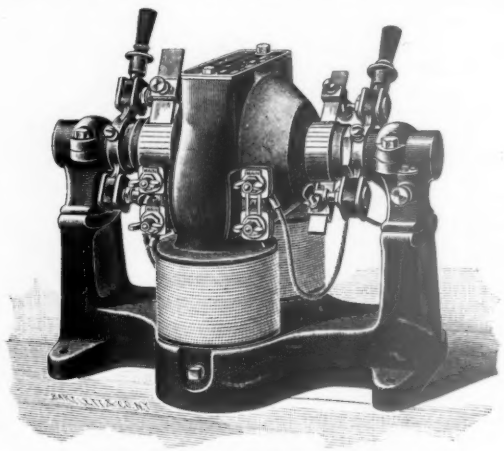
Mr. Albert M. Bullard having completed his year's services with the English Electric Welding Company, sailed August 18 for Boston, where he intends to locate in connection with the electrical business.

Giles Taintor, the new superintendent of the western division of the New England Telephone Company, began his duties at Springfield, Mass., recently, as successor to James Menzies. Mr. Taintor comes from Keene, N. H., where he was formerly superintendent of that division.

Crocker-Wheeler Motor Dynamos.

The Crocker-Wheeler Electric Company, of this city, on account of the growing demand for special purposes differing from the three standard voltages, have gone into the manufacture of machines to transform direct current from one potential to another. These transformers or motor dynamos resemble motors or dynamos in all respects, except that the electrical parts are in duplicate. One side of the machine is devoted to receiving the current from the standard source, and after transformation the other side distributes it at the potential desired.

It is often customary for shops which do silver and gold plating in moderate amounts, to take their curren's, which must necessarily be of large amperage, from 110 volt Edison mains, cutting down the voltage by means of large incandescent lamps. They are thus paying for their current at 110 volts when they are only using two or three volts. By the use of a direct current transformer, a consumption of 10 amperes in this manner would be reduced to about three-fourths of an ampere, saving thereby from 90 to 95 per cent. of the expense. Another instance, which does not recommend itself as much on the ground of economy for actual current consumed as on the ground of compact-



CROCKER-WHEELER MOTOR DYNAMO.

ness and absence of attendance required, is the ringing of bells, etc., in large hotels, which now employ from 50 to 100 battery cells. The smallest size dynamo-motor made, weighing about 30 pounds, will do the work of 250 of these cells. The larger sizes take current at from 600 to 6 volts at the motor, and deliver it at the dynamo end at from 6 to 600 volts, and may be used as well as the smaller sizes for charging storage batteries, generating currents for telegraph circuits, transforming from direct to alternating current for telephone bells, etc.

The Crocker-Wheeler Electric Company is now making these machines in sizes from type one-sixth to three horse-power, the smallest size taking current at the motor end at from 230 to six volts and delivering current at the dynamo end at from six to 230 volts. The shaft of type one-sixth can be so arranged that a dental drill may be attached to it, an emery or polishing wheel put on for polishing and sharpening tools, a fan for raising a breeze, or current taken from the dynamo end for heating cautery wires, and for other medical uses. In generating currents type one-sixth will do the work of 400 gravity cells, and, it is claimed, cost very much less. These machines, one of which we show in illustration, are made with great care and the scientific attention to details for which the Crocker-Wheeler Electric Company is noted, and the demand for them will grow as they become better known. The company already has large orders for them from some of the most prominent concerns in the country.

A despatch from Paris says that the French Transatlantic Company has taken up again the project relative to ocean lights, which was dropped a few years ago. The proposal is that lightships connected by telegraph cables be stationed at intervals of 200 miles across the Atlantic.

Electric Light Wiring of Houses and Buildings.

BY F. C. CARTWRIGHT IN "THE GOVERNOR."

This subject, which has now grown to be of considerable importance to the property owners, is one which is just beginning to receive the attention which it should. Starting from 1883, when incandescent electric lights were few and far between, and looked upon as curiosities, the business has grown to such an extent that there are now in use in the United States nearly 5,000,000 incandescent lamps, and all modern houses and buildings are being wired, so that the lights may be used when the time arrives.

The development of the business has been greatly hampered by the work of ignorant and irresponsible contractors, or, as they term themselves, "practical electricians." Starting in with the construction of speaking tubes, they have graduated into the realms of electric bell work, and thence, by gradual stages, electric gas lighting work; and, having attained this supreme height, they look upon themselves as competent for anything and everything. The poor housebuilder, wanting the proper thing in his home, decides to have it wired for electric light, and so instructs his architect or contractor. They, as his agents, receive bids, and he, comparatively ignorant of the difference between good electric light wiring and bad, accepts the lowest bid, without regard to the ability or standing of the bidder. The work is completed, and two or three or four years elapse before electric lighting is brought within his reach; then, to his annoyance, he finds it necessary to have everything gone over again, and his house practically re-wired. This is a very unfortunate state of affairs, and yet it has been proven true in thousands of cases.

When the electric light wiring was first started many of the companies organized a department and did this work in competition with outside individuals and firms. Following the history of this thing in the larger cities of the East, we find all the larger companies gradually encouraging outside contractors and ridding themselves of this department. Why? Because it was impossible for them to do good work and make money, their balance sheets invariably showing losses. This latter state of affairs commenced developing about 1888 or 1889, and reached its climax in 1890; then, purely as a matter of self-defense, the companies found themselves obliged to return to the original proposition of having a wiring department. If the builders, architects and owners could only fully appreciate the value of having the very best class of work done, matters would become very much more satisfactory. There are dozens of electric wire manufactories, producing hundreds of different grades of wire, the variation in the cost of which, for the same size of copper, is in the proportion of three to one—that is, the highest grades cost three times as much per foot as the lowest.

In the concealed wiring of a building or house it is impossible to get too good a class of wire or work. Of late years even the wire itself has been improved upon by the use of tubes and ducts through which the wire is drawn. This is by far the most advanced state of the art at present, and all of the new buildings and hotels are wired in this way. It enables any portion of the wiring to be withdrawn at any time, in the event of a defect developing itself, and is, therefore, exceedingly desirable. But it is so expensive, comparatively speaking, that most people are afraid of it. It adds from 30 per cent. upward to the cost of the installation.

Next to this class of work stands the use of the very high grade, double or triple braided, rubber-covered wire, run in full accordance with insurance rules governing work of this class. Architects and owners should bear in mind that the difference in the looks of a high grade and medium or low grade insulation is so slight that most people unaccustomed thereto are unable to detect the difference. For concealed work, one of the two classes above mentioned should invariably be used; preferably the first, so-called "conduit" system. Where places are already finished, and it is desired to wire for electric light, the system commonly used is what is known as moulding work, the wiring being run in twin grooved wooden moulding of neat finish, well secured on the exterior of a plaster or wood wall, and tinted to match the color of the finish after completion. This is a very popular form of wiring, since it is fairly neat and not so expensive as to become a hardship.

The fourth and lowest class of work is what is known as cleat wiring, in which wires are run fully exposed, and held in place by means of cleats at distances varying from six to twenty feet apart. This work is sufficiently good for factories and basements, but is rather unsightly in stores. In the installation of electric lighting work, particular attention should be paid to the various safety blocks and appliances which are required by the insurance underwriters. These are always placed in some convenient spot where they can be readily reached. A little care and judgment used in this direction saves infinite trouble and annoyance at later periods. All materials used for things of this kind should be perfectly non combustible; preferably of porcelain or slate. All switches and convenience devices should be carefully located, and also of insulating non-combustible material.

And now comes a very important part of all installations, that is, the question of the proper arrangement and construction of gas fixtures to be used in combination for gas and electric lights. It must be borne in mind that the ground electrical connection through an iron gas pipe is perfect, but is the deadly enemy of all electric light plants; therefore, it must be avoided as far as possible, and, when necessary to approach it, the utmost care must be taken to insulate. It, therefore, becomes of vital importance that a strong substantial joint of some kind which will allow the free passage of gas to the burner, and at the same time cut off all the electrical connection to the earth from the fixture, be used. A very high grade of twin wire must be carried through the fixture to the incandescent light, and all connections to the sockets must be neatly and firmly made. In addition thereto, a non-combustible safety block, with fuse attachment complete, should be placed within the upper canopy of the fixture, where the wire leaves the wall to go to the light.

It is always best for the owner that all fixture connection and work should be done by a responsible house in that line of business, since they are thoroughly familiar with the handling of the fixtures for the gas, and have now, by reason of the growth of the business, taken up the electrical part of it thoroughly and well. In conclusion, let the owner who desires electric light wiring and appliances in his building consult with the local electric light company most agreeable to him, which is engaged in the business of supplying light, and take their advice regarding his installation. Their interests are always his, since they are the ones who will be called upon to furnish him the light when the work is completed.

The officers of the Niles-Mineral Ridge, Ohio, Electric Street Railway Company have been notified by the county commissioners that they must find the center of the public highway on which they are laying their line before proceeding farther with the work. The highway varies from 46 to 60 feet wide, and the commissioners desire that it be made of uniform width.

Improved Lamp Hour Recorder.

Pattee's lamp hour recorder, which has been quietly introduced into a number of plants during the past year, is now being put on the market in an improved form. It is being used with good results on both arc and incandescent circuits, and has been found especially adapted for use with series or series multiple incandescents.

It is likely that many stations will prefer this device to either time circuits or time

PATTEE'S LAMP HOUR RECORDER.

cut-outs, as it gives the consumer a chance to burn his lamps early on a dark day and late in the evening on special occasions. It can also be used in place of a meter for motors working on a steady load, special windings being used for each case. George Cutter, of Chicago, is the maker.

The Weed Model High Speed Engine.

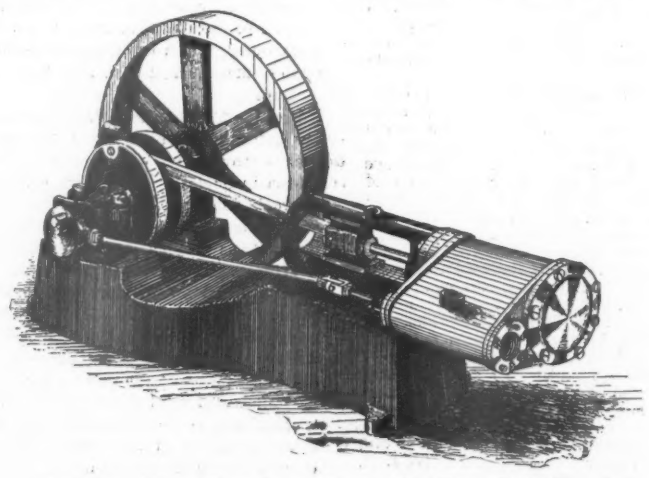
These engines have been designed to meet the wants of a large class of amateurs who wish a model engine, the parts of which are small enough for them to make with limited tools, and will have sufficient power for their needs.

Church & Sleight, 109 Fulton street, New York, make these engines in several sizes. The one-eighth horse-power is adapted to run a scroll saw, small lathe, etc., while the large ones will furnish power for a small shop.

All the parts have been carefully worked out according to the best steam practice, and the castings are provided with "chuck-pieces," by which they can be held in the lathe and finished at one operation.

Each piece is made of the best metal suitable for the purpose, and they are proportioned for real work.

The engines are of the well known center crank style, therefore occupy very little floor space compared with other engines of equal power. The cylinder and steam chest are cast in one piece, with steam ports cored in. The valve is of the double piston style, which reduces the friction and wear on the eccentric, etc., to the minimum. The sliding surfaces are of large proportion, to prevent wear, and in the larger sizes the cross heads are provided with adjusting pieces to take up wear.



THE WEED MODEL HIGH SPEED ENGINE, ONE-HALF HORSE-POWER.

The cross head gives great satisfaction, as it allows the use of a large wrist pin, a very important consideration, to which little or no attention has been paid by model engine makers. The connecting rod has an adjustable bearing on the crank pin, and a double bearing on the wrist pin. The pillow blocks are provided with caps and are adjustable for wear. The fly-wheels are made heavy, which is an important factor. Where small units of power are desired for experimental purposes these engines should find a place.

Rational and Empirical Formulæ Showing the Relation between the Magneto-Motive Force (H) and the Resulting Magnetization (B).

READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, ILL., JUNE 6, 1892, BY CHARLES E. EMERY, PH. D.

(Concluded.)

The corresponding equations showing the magnetizations B_s (mag. lines per sq. inch) in terms of the exciting forces H_s (amp. turns per sq. inch) are as follows:

For H_s=13 to 129 (Steinmetz)

$$(16c) \qquad B_s = 114383 - \frac{2248380}{H_s + 8.838}$$

For H_s=129 to 18500 (Steinmetz & Ewing)

$$(16d) \qquad B_s = 160692 - \frac{31463508}{H_s + 373.34}$$

Sec. 28. Several values calculated by formulæ 16*a* and 16*b* are given in columns 7 and 8, Table I. The largest variation for formula 16*a* appears for $H_1 = 4$. The Steinmetz results at this point are phenomenally low, as will be seen by comparison with the corresponding value for Hopkinson's experiments in column 11. It has been thought desirable to present these careful experiments by Mr. Steinmetz with the Eickemeyer apparatus for comparison with other experiments, but it will be observed by comparing Tables I and II that for all values of B greater than for H_1=10, the Steinmetz results are higher than those customarily given, so much so in fact that as to suggest hesitancy in using the same until the methods of observation are thoroughly discussed. It has been thought that the three specimens of sheet iron tested by Mr. Steinmetz would on analysis prove to be steel, but the results are even higher than those obtained for steel in the Cornell experiments hereinafter referred to, as shown in Fig. 4.

Sec. 29. As a matter of interest the upper limit used in determining Eq. 16*b* was based on Ewing's experiments* with exceedingly high magnetizations, the value selected, as seen at bottom of Table I, being for $H_1 = 2865$, $B = 24650$. This fact makes the results from Eq. 16*b* fall below the

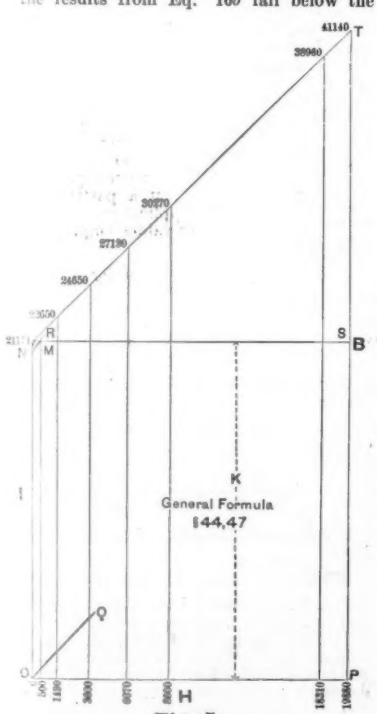


Fig. 5.

higher of the observed Steinmetz results. There would have been no difficulty in confining the formula to the range of observation, when it would have fitted more accurately throughout its whole length, as shown in subsequent applications. The interest attached to a formula reaching so nearly to the extreme limits of observation has been thought to warrant this application. It will be observed, however, that the equation only fits the one value from Ewing selected. The others can only be reached through a more general formula like Eq. 26, to be discussed hereafter. (See column 10.)

Sec. 30. The second application of formula 15 has been made to the tabulated results given at page 143 of the fourth edition of Prof. S. P. Thompson's work on "Dynamo Electric Machinery." This table, as is known, was obtained by averaging the ascending and descending values of B obtained during experiments by Hopkinson on wrought iron. The empirical formula showing approximately the tabulated magnetizations B (magnetic lines per square centimeter) in terms of the exciting forces H (magnetic lines per square centimeter) are as follows:

For H = 1.66 to 52 (wrought-iron)

$$(17a) \qquad B = 16819 - \frac{55656}{H + 3.049}$$

For H = 52 to 666 (wrought-iron)

$$(17b) \qquad B = 20816 - \frac{848915}{H + 117.5}$$

For exciting forces H_s stated in ampere turns per square inch and magnetizations B_s in magnetic lines per square inch these equations take the form

For H_s = 8.5 to 267 (wrought-iron)

$$(17c) \qquad B_s = 108506 - \frac{1842826}{H_s + 15.649}$$

For H_s = 267 to 3420 (wrought-iron)

$$(17d) \qquad B_s = 134292 - \frac{28108425}{H_s + 603.06}$$

Sec. 31. On account of the tables, etc., only the preliminary paragraph of the second part of this paper was read at the general meeting, so this part of the paper has been revised to include the consideration of the experiments presented at such meeting by Dr. Nichols recorded in the paper of Messrs. Thompson, Knight and Bacon on "The Magnetic Permeability of Special Irons for Electrical Purposes." As these experiments were part of the regular course of study in the department of electricity at Cornell University, it is due to that institution and Dr. Nichols, and prevents confusion, without disparagement of the excellent work of still another Thompson and his associates, to refer to such experiments as the "Cornell" experiments, designating the curves by the numbers written thereon in the original paper. (See Fig. 4.)

Sec. 32. An examination of the Cornell experiments shows clearly what we had previously gathered verbally from Mr. Steinmetz, and what has probably been known to large manufacturers for some time, that some samples of soft steel, either in the form of castings or plates, though showing less magnetization for low exciting forces than iron, really attain a higher magnetization than iron as the exciting forces are increased. Though the Cornell paper shows the latter fact in regard to many specimens, it is not true of all, so it is thought that in practice without tests higher values than those of S. P. Thompson for wrought iron should not be considered. The initial magnetizations shown by wrought-iron are, however, too high for steel and mitis metal, so an empirical equation has been developed in the form of Eq. 15 to include both limitations. The initial values have been made to imitate the Cornell results for specimen No. 22 of mitis metal, the results from which are a fair average of those from iron and steel as may be seen by comparing column 8, Table II. The higher values by equation have been caused to follow closely the Thompson-Hopkinson values, column 4, Table II. This compromise curve can, between the limits of the Cornell experiments, be expressed by one equation as follows:

For H = 3 to 70 (Compromise iron and steel)

$$(18a) \qquad B = 17868 - \frac{102576}{H + 5.1165}$$

For H_s = 14 to 350 (Compromise iron and steel)

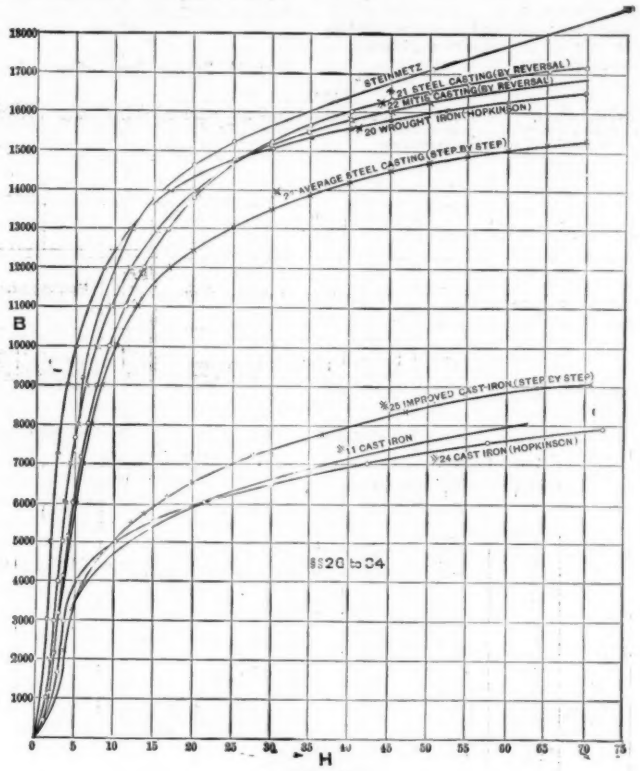


Fig. 4.

$$(18c) \qquad B_s = 115374 - \frac{3396394}{H_s + 26.26}$$

Several values from Eq. 18*a* are given in column 9, Table II.†

Sec. 33. The Cornell curve No. 23 showing magnetizations for average steel castings can, by slightly reducing the lower values, also be expressed by one equation, as follows:

For H = 5 to 70 (Av. steel casting)

$$(19a) \qquad B = 17035 - \frac{124740}{H + 6.304}$$

For H_s = 25 to 360 (Av. steel casting)

$$(19c) \qquad B_s = 109900 - \frac{4130266}{H_s + 32.3546}$$

Sec. 34. The curve, No. 24, Fig. 4, for cast iron, based on experiments by Hopkinson, given by Thompson at page 302, third edition of his book previously referred to, shows results approximately agreeing with those from ordinary American cast-iron, though an improved quality gives higher results, as shown in Cornell No. 25, Fig. 4. The Thompson-Hopkinson curve may be formulated as follows:

For H = 5 to 80

$$(20a) \qquad B = 9572 - \frac{164201}{H + 24.469}$$

For H = 80 to 127

$$(20b) \qquad B = 6300 \times 21.3\,H,$$

a simple rectilinear function which will answer for the limits stated, and the rarely used higher results may be obtained from a table.

For H_s = 25 to 400

$$(20c) \qquad B_s = 61753 - \frac{5436859}{H_s + 125.58}$$

For H_s = 400 to 615

$$(20d) \qquad B_s = 40644 \times 26.774\,H_s$$

The Cornell experiments show for some specimens of cast-iron higher results than those given by Thompson, but for some of the results a failing off during low magnetizations similar to that for steel is to be observed. When high magnetizations are to be secured in any case a safer number of field turns will be secured by using a curve of what may be called the "delayed action" or steel form. We accordingly give a single equation for a curve closely resembling Cornell No. 11, which gives lower initial values for cast-iron than those of Thompson-Hopkinson, but slightly increases the higher values. Such equation is

For H = 3 to 70 (Compromise cast iron)

$$(21a) \qquad B = 9980 - \frac{168120}{H + 19.476}$$

For H_s = 14 to 360 (Compromise cast iron)

$$(21c) \qquad B_s = 64385 - \frac{5566621}{H_s + 99.9586}$$

Sec. 35. It is believed that the several examples above given can be advantageously employed in practice, and that the same illustrate the applicability of the system so that others can construct curves specially adapted to the particular material used. In countries where English units are employed the H_s-B_s formulæ will be found a great convenience, as from them the magnetization in magnetic lines per square inch can be obtained directly from the number of ampere turns per square inch without first ascertaining the several results in lines per square centimeter, and the results can readily be compared with those on another basis by reference to Table I. The numbers of each H-B equation referring to square centimeters are marked sub-*a* and sub-*b* for the earlier and later portions of the curve, respectively, and the same numbers with sub-*c* and sub-*d* added give the corresponding H_s-B_s results for square inches. For some purposes it may be convenient to read magnetizations approximately from a curve on a large scale or from a table, but there are many cases when this will not answer, and it will be found that a particular value can be ascertained by making the full calculations from the formulæ about as quickly as by interpolation and with much greater accuracy and satisfaction. Independent of this the formulæ are of great value for use under the conditions stated in Section 23. When B_s equations of magnetizations per square inch are used, other formulæ in which the values are substituted may require modifications, but the same are of a simple and evident nature.

CONCLUSION.

Sec. 36. The previous discussion in Parts I and II of the theoretical and practical phrases of the general question now form a sufficient foundation for the development of a general equation. It will be observed that in the hyperbolic formulæ, Eq. 15, the first term c of the second member really

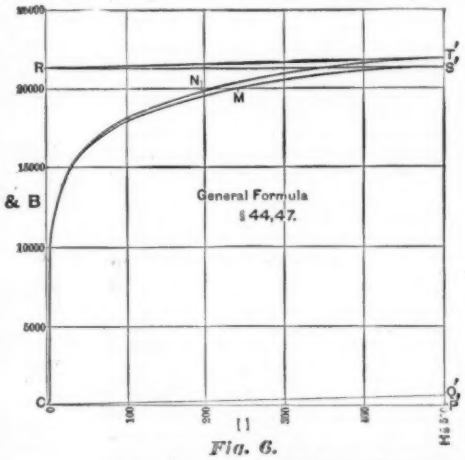


Fig. 6.

represents, so far as this form of equation can, without separating I as in Section 7 and Section 40, the number of lines which will saturate a given material through the range to which the formula is applicable. For instance, the apparent saturation limit for Eq. 17*a* is 16819, but we also observe that the apparent saturation limit for Eq. 17*b* is 20816, or considerably higher than in the other equation applying to the initial portion of the same curve. These formulæ appear, therefore, to sustain a view which has been expressed by others, that the saturation limit rises as the exciting force is increased. This apparent confirmation is, however, due to the inapplicability of the particular formulæ to represent the conditions for widely different values, though it is quite sufficient to merely show between limits the relations of H and B. It should be noted that the upper branch of the curve being an asympote will continually approach the limiting value c in Eq. 15, but never reach it.

Sec. 37. Ewing states distinctly (page 149) that saturation had been definitely reached within the limits of his experiments, though,

* Ewing on "Magnetic Induction." Ed. 1892, Table XII, page 144.

† Since writing the above it has been found that the Frolich function, Eq. 11, which, as has been explained, will not fit closely some forms of H-B curves, can be adapted to show satisfactorily a compromise steel and iron curve throughout a considerable range. The tendency of the function to decrease the higher values can be overcome by making another application of the formula through a different range. The advantage is that, when a table of reciprocals is available, the arithmetical solutions are even more simple than for the equations above given. For this purpose we preferably apply Eq. 11 by dividing through by H, so as to show the permeability, μ, and in this shape the following formula will be found very convenient:

For H = 6 to 105		
(18*f*)	$\mu = \frac{10^7}{554.2\,H + 3664}$;	
For H = 105 to 184,		Compromise
(18*g*)	$\mu = \frac{10^5}{5.132\,H + 80}$;	Iron
For H_s = 30 to 540,		and
(18*h*)	$\mu = \frac{10^7}{108\,H_s + 3624}$;	Steel.
For H_s = 540 to 948,		
(18*i*)	$\mu = \frac{10^5}{H_s + 80}$.	

as stated in different language, additional lines were added above that limit by the action of the solenoid as if no iron were present. It may readily be shown that his experiments sustain these views. If we subtract the values of H, accredited to Ewing in Tables I and III, from the corresponding values of B, we have, as shown in the third column of Table III headed $B-H$, a practically constant quality, which may be called absolutely so in view of the difficulty in making close experimental readings under such extraordinary conditions. The average of the several values of $B-H$ is 21174, and this must certainly mean the maximum or limiting value of I, Section 7, or the number of lines representing the saturation of the particular material experimented upon.

TABLE III, BASED ON EXPERIMENTS OF EWING.

(See foot note, Sec. 29.)

H	B	$B-H$
1490	22650	21160
3600	24650	21050
6070	27130	21060
8600	30270	21670
18310	38960	20650
19450	40820	21370
19880	41140	21260
		7)148220
		$K=$ 21174

Sec. 38. Table III also shows that at these high limits the magnetization increases directly with the exciting force and is numerically equal to the saturation value of I, plus the exciting force H, and indicates that this law extends from these high values back to the origin where the exciting force and magnetizations are zero. If in Fig. 5 we let the ordinates of the triangle $R\,T\,S$ represent the lines of magnetization due to the solenoid, or, substantially in the language used in Section 17, to the number of lines circulated through the space occupied by the iron as if no iron were present, the base and altitude of this triangle will each equal H, and on the principle above stated, this triangle must be superimposed upon a rectangle of which the base equals H and the altitude equals the saturation limit of the iron or I maximum which we will call K. The figure has purposely been drawn to scale to include the highest values given by Ewing (see Table III), viz.: For $H = 19880$, $B = 41140$.

Sec. 39. Further investigations appear to show that the iron which produces a concentration, $K = 21174$ lines per square centimeter reaches saturation with an exciting force H_s between 500 and 2000 lines, whereas less than 100 lines are generally used, so the only part of the trapezoidal Fig. 5 which we refer to in practice is about $\frac{1}{10}$ of its length, or about $\frac{1}{4}$ of the portion included between the ordinates at the origin and the parallel line close thereto marked 500. In order to ascertain how the ordinary H-B curve of magnetization applies within this limit, it is necessary to make another view, Fig. 6, extending from $H = 0$ to 500, the range included between the first two ordinates in Fig. 5, but with the horizontal scale magnified. In this view $R\,T_1\,S_1$ represents the initial portions of the triangle $R\,S\,T$ in Fig. 5, and $O\,R\,S_1\,P_1$ represents similarly a portion of the rectangle below the same. M represents a modified curve of magnetization in which the ordinates of an ordinary H-B curve are shortened by the corresponding values of H when measured from the base $O\,P_1$, and N represents the same curve of reduced height when the ordinates are measured from an inclined line $O\,Q_1$ parallel to $R\,T_1$. (This is the I-B curve of Ewing.) The curve gore between M and N has the same area as the portion of the triangle from the ordinate at the origin to the point of tangency of the curve, so the upper curve N represents the entire H-B curve of magnetization if its ordinates be measured from the base $O\,P_1$.

Sec. 40. We may now formulate on a rational basis the values of B for the whole length of the curve or diagram above developed. There are three distinct influences acting to produce this curve; first, the magnetic lines proportioned to H, shown by the triangle $R\,T\,S$, which affect the result throughout the entire range; second, the concentrating influence I of the iron, the maximum value of which adds the additional magnetic lines K shown by the altitude $O\,R$ of the rectangle, and third, the influence which causes the initial delayed action of the iron, shown by the reversed curve at the origin, O, Fig. 6. (See also Fig. 4.)

Sec. 41. The first influence above stated may be simply expressed by adding H, variable, as a term in the equation. The third influence may be measured by the number of lines necessary to expand the core, disengage the molecular magnets from their accidental positions and arrange them substantially parallel, as explained in Section 16, and as may be represented by starting the curve a definite distance from the origin. Of course, a function could be employed to develop a curve joining the origin with the main curve, but it is unnecessary in ordinary practical work. If we represent by k the number of lines required for the purpose above explained, we have but to use in the equation developed, $H-k$ instead of H, thus practically causing the curve to intersect the axis of abscissæ at a distance, k, from the origin.

TABLE I.

Showing, in different terms, the magneto-motive forces and resulting magnetizations of wrought-iron, in connection with experimental results of Steinmetz, Ewing and Hopkinson, and calculated values from empirical and general formulæ:

1	2	3	4	5	6	7	8	9	10	11
	$1.257H_1$	$6.4514H_1$	$3.109H_1$		$6.4514B$					
Electric Exciting, or Magneto-motive Force.				Magnetization in Magnetic Lines.				Exciting force.	Magnetization.	
Per square centimetre.		Per square inch.		Per sq. centimetre.	Per sq. inch.	Per square centimetre.		General Formula (29) and (30)	Thomson (See Table II.)	
				Steinmetz.		B Formula (16a)	B Formula (16b)	Lines per square centimetre.		
Amp. turns. H_1	Mag. lines. H	Amp. turns. H_2	Mag. lines. H_2	B	B_2			H	B	B
1	1.26	6.45	3.11							
2	2.51	12.90	16.22	1700	10967	1700				
3	3.77	19.35	24.33	4900	27096					
4	5.03	25.81	32.44	7400	47740	7760	.....	5	10086	10000
5	6.29	32.26	40.55	9200	59353					
6	7.54	38.71	48.65	10400	67095	10400				
7	8.80	45.16	56.76	11160	71998					
8	10.06	51.61	64.87	11850	76449					
9	11.31	58.06	72.98	12470	80449	.....	.....	12	12360	13000
10	12.570	64.51	81.09	13070	84320	12797				
12	15.08	77.42	97.31	13750	88707					
14	17.60	90.32	113.5	14260	91997	14215				
16	20.11	103.2	129.7	14600	94190					
18	22.63	116.1	146.0	14900	96126	14941	14944			
20	25.14	129.0	162.2	15200	98061	15202	15200			
25	31.43	161.3	202.7	15700	101287	15682	15785	285	14494	15000
30	37.710	193.5	243.3	16200	104513					
35	44.00	225.8	283.8	16680	107609					
40	50.28	258.1	324.4	17050	109996	.....	17184			
45	56.57	290.3	364.9	17500	112900					
50	62.85	322.6	405.5	17900	115480	.....	17901	52	16036	16000
55	69.14	354.8	446.0	18300	118060					
60	75.42	387.1	486.5	18650	120319					
65	81.71	419.3	527.1	19030	122770					
70	87.99	451.6	567.6	19380	125028	....	18096			
75	94.28	483.9	608.2	19730	127286					
80	100.6	516.1	648.7	20080	129544					
85	106.9	548.4	689.3	20400	131609	.....	.....	105	17945	17000
90	113.1	580.6	729.8	20750	133867	.....	19796	200	19760	18000
	502.	.....	.....	.....	.....	.....	.....	502	21800	
	1002.	.....	.....	.....	.....	.....	.....	1002	22300	
EWING.										
2885	1490	.....	.....	22650	.....	.....	.....	1490	22790	
	3600	18483	23232	24650	159027	.....	24649	3600	24900	
	8600	.....	.....	30270	.....	.....	.....	8600	29900	
	19450	.....	.....	40820	.....	.....	.....	19450	40750	

Sec. 42. The second influence, I, due to the action of the iron in initially building up the magnetization, is, as has been previously discussed, Sec. 7, a function of H or $(f\,H)$ acting only from $H-k$ to the point of saturation. If we let H_s equal the number of lines of exciting force required to produce saturation and K the magnetization at saturation, due to the iron alone, we may write.

TABLE II.

Showing magneto-motive forces and resulting magnetizations of wrought iron, in different terms, in connection with average results of experiments by Hopkinson, tabulated by Thompson, and calculated values from empirical formulæ; showing also Cornell experimental results with mitis metal and calculated values from empirical formulæ connecting the initial results for mitis metal with the Hopkinson results for wrought iron:

1	2	3	4	5	6	7	8	9
ELECTRIC EXCITING OR MAGNETO-MOTIVE FORCE.			MAGNETIZATION IN MAGNETIC LINES.					
Mag. lines.	Ampere turns.		Per sq. cm.	Per sq. inch.	Per sq. cm.	Per sq. cm.	Per sq. cm.	Per sq. cm.
Per sq. cm.	Per sq. cm.	Per sq. inch.	THOMPSON.		Formula (17a)	Formula (17b).	Cornell mitis No. 22.	Formula (18a) Compromise.
H	H_1	H_2	B	B_2	B	B	B	B
1.66	1.32	8.52	5000	32257	5000			
4.0	3.18	20.53	9000	58063	8934		6250	6617
5.0	3.98	25.66	10000	64514	9904		7750	7729
6.5	5.17	33 36	11000	70965	10991		9100	9038
8.5	6.76	43.62	12000	77417	12000		10450	10335
12.0	9.55	61.58	13000	83868	13121		12000	11875
17.0	13.5	87.24	14000	90320	14043		13350	13230
28.5	22.7	146.3	15000	96771	15055	15001	15000	14817
52.0	41.4	266.9	16000	103222	15808	15808	16300	16072
70.0	55.7	359.2				16289	16850	16502
105.0	83.5	538.9	17000	109674		17001		
200.0	159.1	1026.	18000	116125		18143		
350.0	278.4	1796.	19000	122577		19000		
666.0	529.8	3418.	20000	129028		19738		

From $H=0$ until $H=H_s$ and $(f\,H)=K$

(22) $$B=(H-k)+(f\,H)$$

When H is greater than H_s

(23) $$B=(H-k)+K.$$

Sec. 43. We may base the function of H, $(f\,H)$ in Eq. 22 on the fluid function, viz., $(3\,r_2-2\,r_3)^{\frac{1}{n}}$ developed in Section 7. In this function it will be recollected that r is a ratio varying only from 0 to unity. The value of r in this case is evidently the actual number of lines available for excitation, viz.: $H-k$ divided by the exciting force at saturation, viz.: H_s, or

(24) $$r=\frac{H-k}{H_s}$$

Sec. 44. In the form given above the fluid function is, as stated in Section 11, of insufficient intensity. If we consider, as is probable, that the molecular magnets act to change the intensity in accordance with the same laws as the fluid function acts, we can change the intensity shown by the fluid function by simply changing its exponent. As r is fractional, the intensity will be increased by decreasing the exponent. Multiplying such exponent by $\frac{1}{m}$ in which m, is, in a sense, the coefficient of intensification, and putting n equal to the product of $\frac{1}{m}$ by $\frac{1}{2}$, the exponent of the fluid function, we have

(25) $$n=\frac{1}{2\,m}$$

Substituting such fluid function with n as the exponent in place of $(f\,H)$ in Eq. 22 we have

For $H=0$ to $H=H_s$ and $(f\,H)=K$

(26) $$B=(H-k)+K\left(3\left(\frac{H-k}{H_s}\right)^2-2\left(\frac{H-k}{H_s}\right)^3\right)^n$$

For H greater than H_s, Eq. 23 applies as before.

That is, above the point of saturation the iron ceases to act to concentrate magnetic lines, so the fluid function must be caused to disappear as r reaches its limiting value, unity.

Sec. 45. Before substituting actual values in the above equation, we will examine the remarkable properties of the simple equation underlying the fluid function, viz.:

(27) $$y=a\,r^n$$

when r is a ratio less than or not greater than unity and the exponent n is fractional or not greater than unity. If in Eq. 27 $n=1$ the equation is that of a straight line and the different values of y, as r is varied from 0 to unity, will plot in a diagonal. (See Fig. 1.) If $n=0$ the ordinates for all values of r will equal unity and the same will all plot in the upper horizontal line of Fig. 1. For the lowest conceivable fractional value of n the values of the ordinates in the equation will plot in a right angle. This curious function therefore develops two sides of a triangle as one of its limiting values and the diagonal of the same for its other limiting value, and for values of n, intermediate between 0 and 1, the whole area of the triangle will be filled with similar curves gradually changing in shape from a right angle to the hypothenuse of a right angled triangle. If, instead of r, a function of r be used, for instance, the fluid function shown by the reversed dotted curve in Fig. 1, the limiting values of $(f)\,r$ will be the same, viz., the right angle and the diagonal, but for decreasing values of n the triangle will be filled with curves modified in shape by that of the reversed curve. We can then intensify the ordinates of the fluid function embodied in Eq. 26. (See Section 43), as described in Section 44, by decreasing its exponent by a multipler $\frac{1}{m}$, so as to develop a curve either departing little from a diagonal, as in Fig. 1, or so as to approximate a right angle, or, at will, to take any intermediate position.

Sec 46. It is evident, in accordance with the principles above explained in relation to Eq. 27, Sec. 45, that the values of k, K, H_s and n, Eq. 26, can be so modified as to embrace the same conditions and trace a curve practically identical with any regular H-B curve of magnetization. The equation is, however, not a simple one to operate, so no attempt has been made to use fractional exponents extended to several decimal places as would be required to fit a particular curve. In a particular application now to be presented, the constant values employed were as follows:

$k=2.3$, $H_s=500$, $K=21300$

and $m=6.25$, so, from Eq. 25,

(28) $$n=\frac{1}{2\,m}=\frac{1}{12.5}=0.08$$

On this basis we have by substitution in Eq. 26

For $H=0$ to 502

(29) $$B=(H-2.3)+2130\left[3\left(\frac{H-2.3}{500}\right)^2-2\left(\frac{H-2.3}{500}\right)^3\right]^{0.08}$$

For H greater than 502, from Eq. 23, we have

(30) $$B=(H-2.3)+21300=H+21298$$

Sec. 47. A curve derived from the general equation in the form above is shown at N in Fig. 6, and several values are given in column 10 of Table I for comparison with the results obtained by Steinmetz, shown in column 5, and those of Hopkinson by Thompson, shown in column 11. The initial rise shown by this particular form of the general equation is more like that of Thompson than of Steinmetz; the curve then rises less rapidly, and coincides with Thompson for $B=16000$, after which the general equation values run intermediate between those of Thompson and Steinmetz, and finally correspond with the experimental results of Ewing, shown at the bottom of the table, with a surprising degree of accuracy, considering the difficulties of the problem.

Sec. 48. It thus appears that, by the combination of the fluid function with a rectilinear one, a general expression is produced on a rational basis applicable both for moderate magnetizations and the exceedingly high ones given by Ewing. It has been shown in Part I, Section 11, that "the laws relating to the flow of elastic fluids impose no condition antagonistic to the adoption of the theory of etheric flow, but, on the other hand, the elements of the fluid function vary in the right direction and show a limiting value akin to magnetic saturation."

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

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We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

FOND DU LAC, WIS.—The Fond du Lac street railway has been sold to W. G. De Celle, of St. Paul, Western agent for the Westinghouse Company. An electric equipment and incandescent lighting plant will be put in.

FORT WAYNE, IND.—The Fort Wayne Electric Railway Company, capital, $1,000,000, has filed articles of incorporation. The directors are Frank K. Bass, Stephen B. Bond, Andrew Squire and James M. Barrett.

DAYTON, O.—It is stated that an electric railroad will be built from Dayton to Easton, a distance of 25 miles.

BUFFALO, N. Y.—Contracts for the construction of the Buffalo, Kenmore and Tonawanda Electric Railway have been let. The Field Engineering Company will do the work which is to cost $125,000.

CHIPPEWA FALLS, WIS.—C. W. Riely and F. J. Jersey, of St. Paul, are trying to secure a franchise to build an electric street car line here. They propose to invest $70,000.

LOUISVILLE, KY.—The Kentucky and Indiana Bridge Company will equip its road to New Albany Knobs with electricity. The cost of making the route an electric line is $80,000.

WASHINGTON, D. C.—The Brightwood Railway Company, C. P. Williams, secretary, will begin work on the construction of its electric road, September 18.

MUNCIE, IND.—The council has granted a franchise to the Citizens' Street Railway Company, which has just been incorporated with a capital of $250,000. The directors include W. N. Whitely, O. S. Kelly and W. A. Scott, of Springfield, O.; A. L. Conger and K. B. Conger, of Akron, O.; J. S. Tolley, of Terra Haute, and James Boyce, of Muncie. The company will at once put in the electric trolley wire system.

FOSTORIA, O.—The Tiffin and Fostoria Electric Railway Company has been incorporated with a capital of $175,000. The road will be 13⅝ miles in length, and will cost $150,000 equipped and ready for running. Hon. Charles Foster, Ross Crocker and Andrew Emerine, of this place, and Hon. George E. Seney, J. A. Beatty and R. W. Brown, the promoter, of Tiffin are incorporators.

NORWALK, OHIO. — Esbon Blackmar, of Toledo, has sold his franchise for an electric road to Philadelphia parties, who will at once begin construction.

ASHLAND, KY.—Contracts have been closed and work will be begun at once on the electric street car line to Catlettsburg.

ZANESVILLE, OHIO.—The board of trade has appointed a special committee to consider the feasibility of building a new line of electric road to traverse the city.

DETROIT, MICH.—Managing Director Cottrell, of the Detroit Citizens' Street Railway Company, announce that the company will not accept the franchise as recently passed by the city council.

NEW BRITAIN, CONN.—The New Britain Tramway Company is an applicant to common council for permission to change its system from horse to electric power.

ASHLEY, PA.—Coalville Passenger Railroad Company has been granted leave to make extensions to this place, and the Wyoming Valley Traction Company has been authorized to construct an electric line here.

Electric Light and Power.

UHRICKSVILLE, O.—The United Electric Light and Power Company has a franchise to build an electric railway from Uhricksville to Dennison.

ROGERS PARK, ILL.—Sealed proposals are invited by Edward A. Sharpe, village clerk, for a franchise for a gas and electric light plant.

HAMILTON, O.—The Hamilton-Brush Electric Light Company will begin business anew after a cessation of several years. The company will establish a plant for furnishing electric light and power. Joseph McMaken is president, and Philip Kraft, secretary.

YPSILANTI, MICH.—A new electric light company has been formed with H. B. Perkins, president.

ELKIN, N. C.—T. J. Lillard will establish an electric light and power plant here.

IOWA FALLS, IA.—Bids for an electric light franchise will be received until September 5 by Frank D. Peet, city recorder.

DETROIT, MICH.—George E. Fisher, manager of the Commercial Electric Light Company, at the mayor's request, is preparing plans and specifications showing what it will cost the city to build and equip an electric light plant of its own.

PEORIA, ILL.—The trustees of the Soldiers Home have decided to recommend that a $10,000 electric plant be put up in the home and grounds.

PAWTUCKET, R. I.—Bids for the electric lighting of the city of Pawtucket for the term of one, three or five years will be received by the joint standing committee on street lights up to 8 o'clock P. M., on Tuesday, September 20, 1892.

PUEBLO, COLO.—An Eastern syndicate will shortly secure the three electric light franchises for $750,000, and the street railway for an equal sum.

CIRCLEVILLE, O.—The Circleville Light and Power Company has been granted a 25-year franchise for an electric railway. The line is to extend the entire length of Main and Court streets, and work will commence at once.

PEORIA, ILL.—The Edison Eltctric Light and Power Company hus been granted permission to erect poles and string wires throughout the city, for the purpose of furnishing light, heat and power.

REDWOOD FALLS, MINN.—The city council is considering the establishment of an electric light plant.

RADFORD, VA.—A franchise for an electric light and power plant has been granted to A. P. Page and others.

HUMMELSTON, PA.—There is a movement on foot to establish an electric light plant.

HOOKSETT, N. H.—The Hooksett Electric Light Company has organized, by electing Frank C. Towle, president; Geo. A. Robie, vice-president; and Eugene Head, treasurer. An electric plant will be erected at once.

GONZALES, TEX. — The Gonzales Electric Light and Power Company has been organized and the following officers elected: W. S. Fly, president; T. F. Harwood, vice president; G. N. Dilworth, treasurer, and R. H. Walker, secretary. It will be chartered for $20,000 and power will be furnished by T. S. Walker's dam.

WEST NEWTON, PA.—This town has voted to increase its indebtedness to $30,000, for the purpose of building an electric light plant.

CADIZ, OHIO.—A stock company has been formed for the construction and operation of an electric plant.

ALBIA, IOWA.—Albia Electric Light and Power Company; capital, $30,000. Promoters, S. R. Jackson, Max Loeb, Tom. D. Lockman, Albia, Iowa. Incorporation papers sent to J. C. Marry, Albia, Iowa.

Manufacturing Companies.

MINNEAPOLIS, MINN.—The Leffler Electro-Magnetic Railway Company, for the manufacture of electric machinery and appliances. The company is capitalized for $1,000,000 and the officers are: President, N. F. Hawley; vice-president, F. A. Dunsmoor; secretary, Leslie C. Lane; mechanical superintendent, Paul W. Leffler.

CHICAGO, ILL. — The Chicago Electrical Construction Company; capital, $150,000. Incorporators, Wm. H. Passmore, Wm. E. Schofield and Wm. C. Jones.

BOISE CITY, IDAHO. — Northwest General Electric Company; capital, $1,750,000. Promoters, T. C. Sullivan, H. W. Turner, C. A. Daigh, B. F. Meek, Jr., W. G. De Cule, St. Paul, Minn.

JERSEY CITY, N. J.—The Dahl Electric Company; capital, $500,000. Incorporators, Francis H. Leonard, Jr., of Syracuse; Simeon L. Phillips, of New York, and Charles B. Hughes, of Jersey City.

EVERETT, WASH.—Everett Electric Brick Company; capital, $20,000. Promotors, C. G. Slayton, Melvin Swartout, Wm. F. Brown, Robt. Medergesaess, F. O. Coe.

MOUNT ARLINGTON, N. J.—Hopatcong Hotel Company; capital, $135,000. To construct, operate and maintain gas, water and electric light plants. Promoters, Jno. T. Rossell, W. C. Culver, H. M. F. Randolph. Incorporation papers sent to Clark & Culver, 80 Broadway, city.

Telephone and Telegraph Companies.

TALLAHASSEE, FLA.—The St. Marks' Lumber Company will erect a private telegraph line from their mills to Tallahassee, a distance of 21 miles.

BRISTOL, N.H.—The selectmen have granted the petition of the Bristol Telegraph and Telephone Company to erect its lines to South Bristol, Alexandria, Bridgewater and Hebron.

Consolidation.

BUFFALO, N. Y.—The Brush Electric Light Company and the Thomson-Houston Electric Light and Power Company, of Buffalo, have consolidated under the title of the Buffalo General Electric Company. The capital stock is placed at $1,900,000, and the chief promotors are Daniel O. Day, Geo. Urbun, Jr., and Wm. W. Sloan.

Change of Organization.

WATSONTOWN, PA.—The electric light plant has been purchased at sheriff's sale, by local parties, who will reorganize the company and put in a direct plant.

Decrease of Capital Stock.

PEORIA, ILL.—The Peoria Rapid Transit Company; from $50,000 to $30,000.

Increase of Capital Stock.

YPSILANTI, MICH.—Ypsilanti Electric Company; from $25,000 to $30,000.

LITERARY.

The Homestead strike will receive in the September number of *The North American Review* the ample attention which that periodical always gives to important events. It is to be discussed from three points of view: The Congressional view, by Congressman W. C. Oates, chairman of the Investigating Committee; the constitutional view, by the Hon. George Ticknor Curtis; and the Knight of Labor's view, by T. V. Powderly.

TELEPHONE TALK AND COMMENT.

Mr. A. C. White, of the Providence Telephone Company, was in New York, a few days last week, looking into the latest developments of the art, with a view of making the new central office building and subway system to be constructed at Providence equal to the finest in the United States.

Work on the New York and Chicago long distance telephone line is being rapidly pushed by a large construction force working in three sections. We can confidently predict that in the early Fall New Yorkers can easily talk to their friends in the World's Fair city.

The new building and switchboard of the Hudson River Telephone Company, at Albany, will be ready for occupancy in the Fall. It is said among telephone men that the switchboard, subways and system of distribution which has been worked out by this company will represent the most advanced stages of the telephone art and will contain many features of novelty and interest. Since the death of General Manager Uline, Mr. Hawley, son-in-law of the deceased, together with the secretary and treasurer, Mr. H. L. Storke, have been in charge and successfully continued the work of reconstruction which was inaugurated during the life of Mr. Uline.

Hon. Samuel Bryan, president of the Chesapeake & Potomac Telephone Company, ex-postmaster general of Japan, came over from Washington to cool his heated brow in the metropolis last week. Mr. Bryan's social standing and phenomenal executive ability make him a most valuable exponent of telephony at the national capital.

The New York and New Jersey Telephone Company is erecting new central offices at Williamsburgh and Jersey City. This is in pursuance of Vice-President and General Manager Sargent's plan to make all the territory contiguous to New York city, for telephone purposes at least, part of the greater New York. This policy is one of comprehensive breadth and magnitude, characteristic of the unusual administrative ability of its author. Mr. Sargent is now enjoying a brief respite from his work at Ellis Park, Vt.

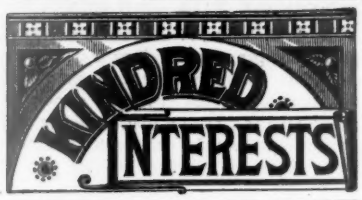
New Yorkers are rapidly adopting the new speaking tube system recently issued by the American Bell Telephone Company. We look for the rapid introduction of this system into the rooms of all first-class hotels.

The New England Telephone and Telegraph Company is actively preparing for the installation of a new multiple switchboard of the latest pattern in the Tremont street district, where a modern telephone building has been erected for its reception. General Manager Keller and Electrician Farnham are also pushing along the good work of perfecting the service at many other points in their extensive territory.

The Southern New England Telephone Company has finished the relaying of 1,500 feet of new cable at a point between Fisher's Island and Pine Island, where that length of old cable had to be spliced to the new when it was recently laid, because there wasn't enough of it at the time to complete the connection. They also laid a new length of cable between Pine Island and Eastern Point. This work assures the public that there will be no more exasperating delays in communication between Fisher's Island and the mainland.

In a recent issue the Paris *Figaro* gives the following bit of information:

Tests are to be made with M. Banarè's microphone during the marine manœuvres, which commenced July 27. These microphones are constructed for the purpose of revealing the approach of distant vessels, or more correctly speaking of making audible the noise produced by the motion of the screw of such vessels. Again it is intended to test captive balloons, which, ascending from the deck of a vessel, are connected telephonically with the people on board.



The Lowell Manufacturing Company, Limited, of Erie, Pa., have sent out very pretty catalogues describing the "Niagara" dynamos and motors which they manufacture.

The Enterprise Electric Company, Chicago, now has its St. Louis branch house running in full blast. It is located at 15 North Ninth street and Mr. W. H. Ferris is the general manager. Business starts in briskly, the wire sales being especially good. The National India Rubber wire seems to have "caught on" in this territory.

The National Water Tube Boiler Company, of New Brunswick, N. J., have just completed a shipment of their boilers to the United States Electric Lighting Company, Washington, D. C. Fifteen large freight cars were required to transfer the boilers. This steam plant will be a duplicate of that furnished the same company last year, and when erected the full boiler plant will be among the largest in use in electric light stations in the country.

The Berlin Iron Bridge Company, of East Berlin, Conn., will design and build the new buildings for the New Orleans and Carrollton Railroad Company at New Orleans, La. The power house is 80 feet wide by 130 feet long, with brick walls and an iron roof. The car shed will be built entirely of iron, 130 feet wide by 140 feet long. It is the intention of the New Orleans and Carrollton Railroad Company to have the finest electric railroad plant in the Southern States.

H. Ward Leonard & Company.—One of the handsomest isolated plants being put in at present is that in the power station of the Broadway Cable Road. The plant will comprise between 3,000 and 4,000 lamps and quite a number of electric motors. Slow speed dynamos, coupled directly upon the engine shaft, will be used. H. Ward Leonard & Company, Electrical Exchange Building, New York, are acting as the bulk contractors for the entire electrical equipment.

Queen & Company, Philadelphia, have laid in a big stock of Deprez-Carpentier ammeters and voltmeters. These instruments are strictly dead beat, so that readings can be taken very quickly, and the scales are graduated from zero up. Being mounted in compact nickel-plated metal cases, they are adapted for portable testing as well as for switchboards. The prices are very moderate, and a considerable number have already been sold. For alternating currents the Cardew voltmeter is recognized as a standard switchboard instrument, while an essential feature is its equal correctness when used on continuous circuits. Queen and Company, who own the American patents, are making these voltmeters in quantity to supply the demand, and have also reduced the prices considerably, which announcement is of importance to intending purchasers. The merits of the Cardew instruments are fully set forth in price-list No. 290, which can be obtained from the makers for the asking.

The Lillian Russell Special.

We have received from Mr. M. C. Roach, general Eastern passenger agent of the New York Central & Hudson River Railroad, a copy of the itinerary of the special Wagner train conveying the Lillian Russell Opera Comique Company from New York to San Francisco. The Lillian Russell special consisted of six cars and left New York last Sunday at 10.10 A. M., over the New York Central arriving in San Francisco, at 11.45 P. M. Thursday. The train was thoroughly equipped for the comfort and convenience of the troupe, and the pamphlet giving the itinerary was handsomely printed and embellished with illustrations in colors.

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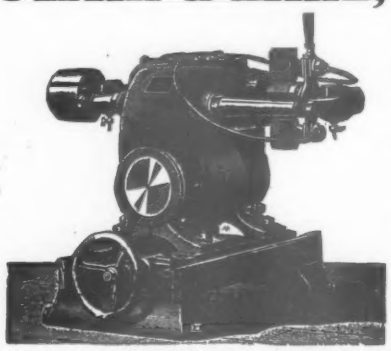

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